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NAUTICAL SERIES



ELEMENTARY SEAMANSHIP

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A MANUAL
OF
ELEMENTARY SEAMANSHIP

GRIFFIN'S NAUTICAL SERIES.

EDITED BY EDW. BLACKMORE,

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A MANUAL
OF
ELEMENTARY SEAMANSHIP.

BY

D. WILSON-BARKER,

MASTER MARINER; F.R.S.E., F.R.G.S., ETC. ETC.;

YOUNGER BROTHER OF THE TRINITY HOUSE.

*WITH FRONTISPIECE, TWELVE PLATES (TWO IN COLOURS),
AND ILLUSTRATIONS IN THE TEXT.*

LONDON:
CHARLES GRIFFIN AND COMPANY, LIMITED,
EXETER STREET, STRAND.

1896.

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Dedication.

THIS LITTLE VOLUME IS
AFFECTIONATELY DEDICATED TO
THE MEMORY OF
MY FATHER,
DAVID WILSON-BARKER.

EDITOR'S PREFATORY NOTE.

THIS SERIES has been designed to meet the growing desire on the part of Officers in the Mercantile Marine for a MORE SCIENTIFIC INSIGHT into the principles of their profession, and the sciences upon which the Art of Navigation is founded. The treatises are, for the most part, WRITTEN BY SAILORS FOR SAILORS; and, where this is not the case, by authors who have special knowledge of the subjects dealt with and their application to the Sailor's life. The treatment is thoroughly scientific, yet as free as possible from abstruse technicalities, and the style such as will render it easy for the young sailor to gain a knowledge of the elements of his profession by private reading and without difficulty.

E. B.

LONDON, *October* 1896.

AUTHOR'S PREFACE.

A NEW Elementary Manual of Seamanship may perhaps appear, at first sight, superfluous. Its production has been decided on by the Author because of his conviction that none of the many excellent works extant sufficiently meet the needs of Apprentices and Junior Officers in the Mercantile Marine. This little work is an introductory text-book for beginners; it does not pretend to complete their nautical education, nor in any sense to supersede that practical training in the details of their profession, an intimate acquaintance with which is so unattainable, except in the course of life on board ship.

The Author hopes, at some future date, to consider and develop more fully, in another volume, many practical problems for the use of advanced students. He is an advocate for collective rather than individual effort in dealing with the many difficult questions pertaining to the profession of the sea, and would gladly receive suggestions on any points from his fellow sailors, for use in future editions, should such be required.

It should ever be the aim of a young seaman to study the behaviour of the vessel in which he sails, under all possible conditions of weather and sea; for on a thorough understanding

of these points will depend his ability to handle his vessel properly under difficult circumstances.

The Author's best thanks are due to Captain A. Walker and other friends for their assistance and suggestions in various Sections; and to Lord Kelvin for his kindness in supplying two of the Illustrations.

GREENHITHE, *October* 1896.

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- Page 2, 24 lines from bottom, *for* "No. 3 hold" *read* "No. 2 hold."
- „ 3, bottom line, *for* "topmast crosstrees" *read* "topmast head."
- „ 7, 10 lines from top, a comma left out after "satisfactorily."
- „ 31, 4 lines from bottom *shou'd read* "**quarter** or **round** (2),
end (3)."
- „ 79, 11 lines from top *delete* ; after "up."

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ELEMENTARY SEAMANSHIP.

PART I.

THE BUILDING OF A SHIP, PARTS OF HULL, MASTS, ETC.

The Building of a Ship—Launching—The Hull, description of parts—
Masts and Spars—Sails—Rigging—Going aloft—Boating—The
Mariner's Compass—Marline-spike—Belaying-pins and Cleats—
Watches and Time.

BUILDING OF A SHIP.

THE first elements of knowledge in regard to a ship are the names of the different parts of the hull, as the general structure of the body of a vessel is called.

The hull consists of a keel, frames, girders or beams, skin or plating, and decks. The keel is the foundation of the ship.

The accompanying Plate I. will familiarise the student with the disposition of the parts of the hull better than any written description could do. He must not, however, content himself with the plate, but must go, book in hand, round the ship, and identify the various parts for himself.

When a ship is to be built, the naval architect prepares his plans according to the dimensions given and the trade for which she is destined. Plans are all drawn to a certain scale; some parts are separately prepared on larger scales. These plans are taken to the shipyard, where full-sized drawings are made in plan and section, on the "scribe-board," a specially prepared flooring in the mould loft. From the drawings on this board, the templates in wood for the different parts are made; and the frames, girders, &c., are set off from it, and bent on the bending-slab. Meanwhile, the space on which the vessel is to be constructed is prepared;

room is left for launching her into the water; and a slope arranged down which she can be slid with the least possible difficulty. A line of blocks is built up on the space, and on these blocks the keel is laid. Poles, on which the staging for building the vessel is erected, are placed at either side of the line of blocks, at a slightly wider distance than the extreme width of the vessel. The keel plates are laid on the blocks; then the frames, and bow and stern frames are attached. They are held temporarily in position by means of ribband-bands. The floor-plates and girders are next added, then the plating and decks; the whole, when fitted together with bolts or rivets, forming a rigid and practically homogeneous structure. A special kind of cradle, called a "launching way," is built under the vessel, in such a manner as to take her weight, and when the vessel is ready for launching, the ways are well greased with Russian tallow, so that she slides easily down them. Engines, boilers, and deck-fittings are put in after launching.

DESCRIPTION OF PARTS OF HULL.

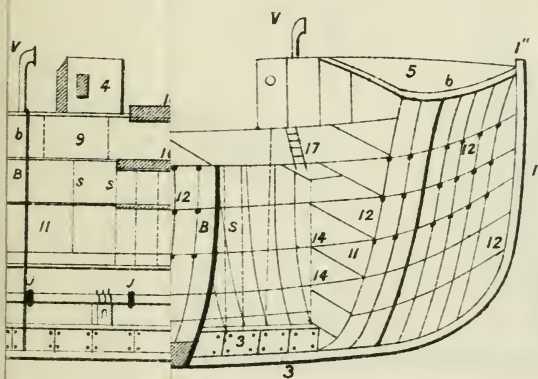
PLATE I.

This plate represents one side of a modern cargo steamer with the plating removed, and half section except in No. 3 hold, in which the frames have been carried right round. Necessarily much detail has been omitted. The water ballast would be carried in the cellular bottom, the depth of which is that of the centre plates, 3', above the keel.

The keel is that known as the flat plate keel.

1 = Bow.	13 = Beams or girders.
1" Stem.	14 Stringers.
2 Stern.	15 Floor plates.
2' Stern-post.	16 Hatchways.
2" Rudder-post.	17 Ladders.
3 Keel.	V Ventilators.
3' Centre plates of keel.	S Stanchions.
4 Deckhouses.	P Propeller, or screw.
5 Forecastle head.	PT Stern tube.
6 Bridge.	PS Propeller shaft, with joints
7 Poop.	J, and thrust-block T.
8 Upper deck.	B Bulkheads.
9 Main deck.	A Boiler-room.
10 Lower deck.	C Engine-room.
11 Holds.	F Funnel.
12 Frames.	R Rudder.

Watertight doors are fitted in many bulkheads, and these doors should close from the upper deck. In each bulkhead is also fitted



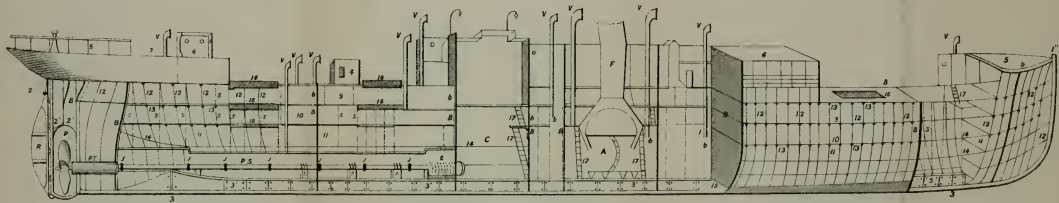


Plate I.

a sluice valve, which enables water to be run from one compartment to another, and finally to the pumps in the engine-room.

FITTING ALOFT.

Having acquired a general knowledge of the hull of a vessel and its structure, we now run through the names of the masts and spars, of the sails that are attached to and spread on them, and of the rigging, which gives rigidity and movement.

PLATE II.*

SPARS.

I. = Lower mast.	X'. Cross-jack yard.
II. Topmast.	XI. = Lower top-sail yard.
III. Topgallant mast.	XII. Upper "
IV. Royal mast.	XIII. Lower topgallant yard.
V. Bowsprit.	XIV. Upper "
VI. Jibboom.	XV. Royal yard. "
VII. Dolphin striker.	XVI. Tops.
VIII. Spanker boom.	XVII. Crosstrees.
IX. " gaff.	XVIII. Topmast cap.
X. Lower yard.	XIX. Mizzen trysail gaff.
	XX. Sheerpole.

SAILS.

A = Course.	H = Stays'l.
A' Crossjack.	I Topmast stays'l.
B Lower tops'l.	J Topgallant staysail.
C Upper tops'l.	K Royal staysail.
D Lower topgallant sail.	L Inner jib. } †
E Upper "	M Outer jib. }
F Royal.	N Mizzen trysail.
G Spanker.	O Main trysail.

P = Fore trysail.

With the exception of the crossjack, the courses and all other sails are distinguished by prefixing the name of the mast on which they are set; for instance, we have the "main course" or "main-sail," the "main topmast staysail," the "fore topmast staysail," the "lower fore topsail," and so on. But the jibs are known as the "inner jib" and the "outer jib."

RIGGING.

1 = Lower rigging or shrouds.	3' = Topmast cap backstays.
1' Cap shrouds.	4 Topgallant rigging.
2 Topmast rigging or shrouds.	5 Topgallant backstays.
3 Topmast backstays.	6 Royal backstays.

* Some details are omitted for the sake of clearness.

† The inner and the outer jib run on their own stays, both of which often go to the topmast crosstrees.

RIGGING—(*continued*).

7 =	Lower stay.	23 =	Brails.
8	Topmast stay.	24	Lower yard braces.
9	Topgallant stay.	25	Lower topsail braces.
10	Royal stay.	26	Upper "
11	Bobstays.	27	Lower topgallant braces.
12	Bowsprit shrouds.	28	Upper "
13	Jib guys.	29	Royal braces.
14	Back ropes.	30	Lower lifts.
15	Jib stays.	31	Lower topsail lifts, unhooked when sail set.
16	Futtock rigging.	32	Upper topsail lifts.
17	Lifts of gaffs.	33	Lower topgallant lifts, un hooked when sail set.
18	Vangs.	34	Upper topgallant lifts.
19	Spanker boom lift.	35	Royal lifts.
20	Signal halliards.	36	Footropes.
21	Sheets.		
22	Tacks.		

In speaking of sails or gear the identity of any one is marked, as we have seen, by prefixing the name of the mast to which it belongs. For instance, if we wanted to make any allusion to the brace attached to the lower main yard on the starboard side, we should say the "starboard main brace"; and in like manner we should speak of the "lower main topsail," the "maintopmast stays'l," and so on.

RIGS. (*See Frontispiece.*)

Sailing-vessels may be divided into two classes:—

(1) Those that only carry fore-and-aft sail, jibs, staysails, spankers, or drivers, and trysails, &c. This style of rigging is known as "*fore-and-aft rig*."

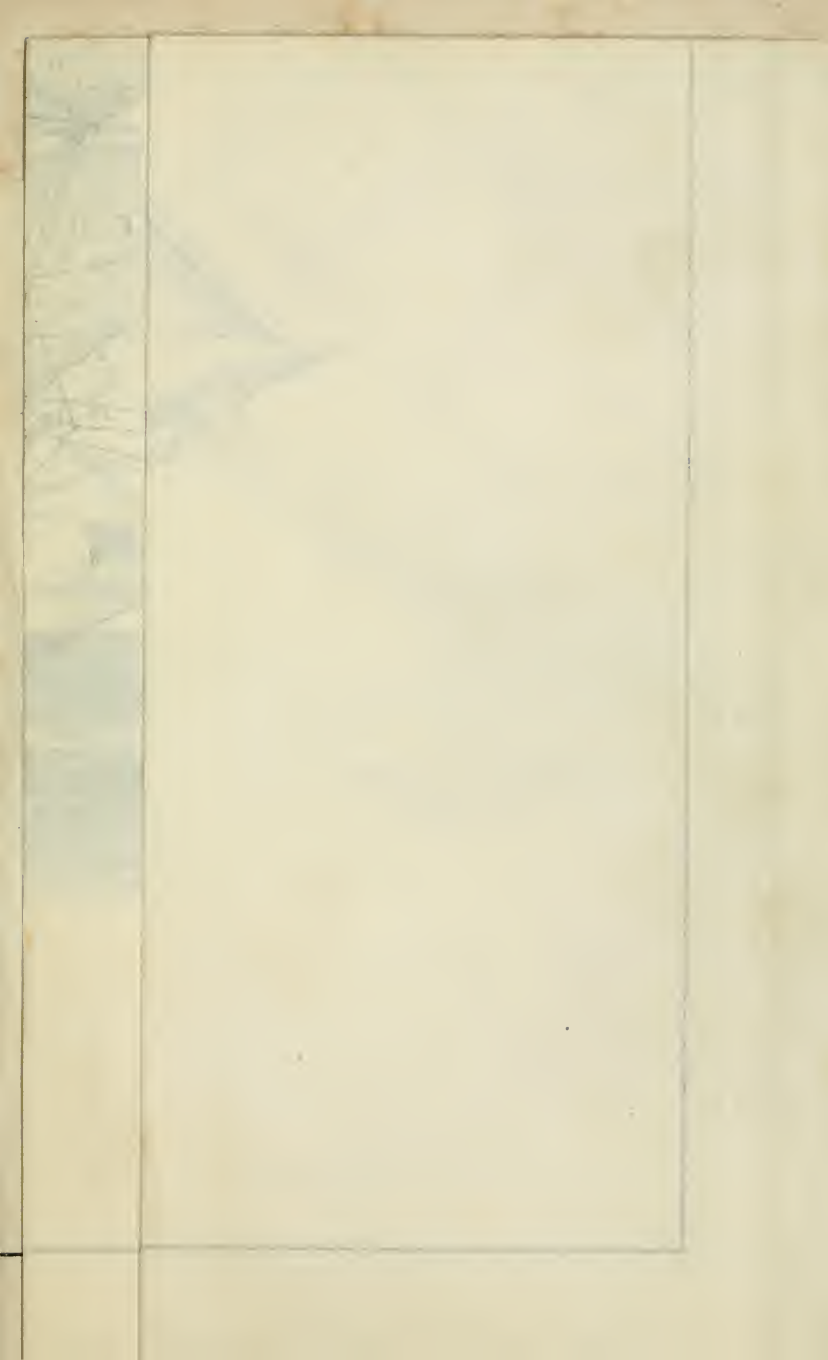
(2) Those that have square sail are called "*square rigged*," and have always fore-and-aft sails as well.

The former can sail closer to the wind than the latter. The Frontispiece gives an idea of the appearance of the different rigs.

Rigs of steamers have the same names as those of sailing-vessels; thus we speak of a "barque-rigged" steamer, or a "fore-and-aft rigged" steamer, &c.

GOING ALOFT.

Going aloft becomes an easy matter with a little practice. It is the custom at sea to go up the weather side, as the "weather-rigging," being quite tight, is ascended much more easily than the "lee-rigging," which is slack. Ascent of the lee-rigging is also made difficult by the yards, which press against the rigging. In going aloft, the hands should take hold of the shrouds, not of the



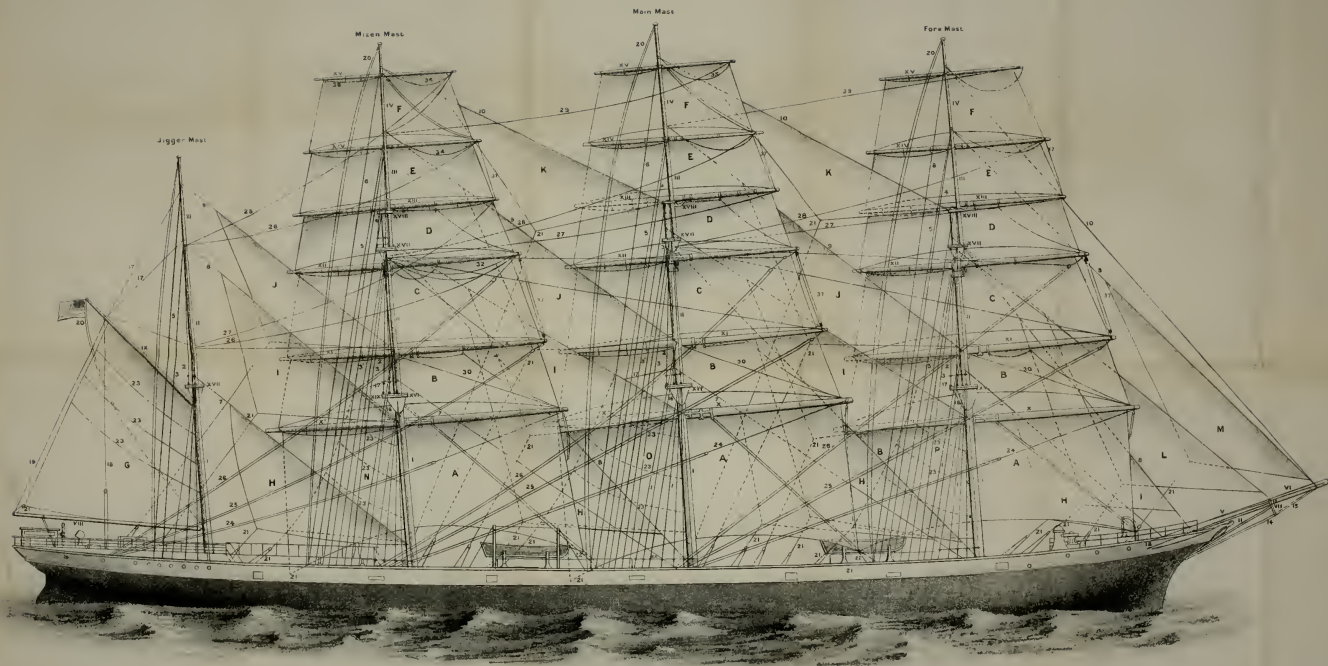


Plate II.

ratlines. The ratlines, where futtock-rigging is fitted, are generally stouter than those on the rigging. The "catch ratline" (as the first on the topmast rigging is called) is particularly stout, as it is the one caught first over the rim of the top.

BOATING.

A sailor should take every opportunity of thoroughly mastering all boating details. At sea, as a rule, he has no chance of acquiring such knowledge; boats are then used only in cases of accident, when ignorance in their manipulation may have serious consequences.

The boats generally carried by sea-going vessels are lifeboats and cutters; all lifeboats are fitted with cork, or air-tight chambers. Every boat should have a supply of sails, masts, oars (two spare ones), rowlocks (one spare one), two boat-hooks, bailer, two plugs, two barécas of fresh water, a tin of biscuits, a rudder and tiller. The rowlocks and rudder should be fitted with lanyards.

It is very essential in pulling that the hands should be placed nearly together (about 2" or 3" apart) on the loom of the oar, the elbows being kept close to the sides in the stroke and finish. A good long steady stroke is the proper one. Care should be taken, in feathering the oar on the recovery, to raise the blade well out of the water, so as to clear the waves; if an attempt is made to feather close to the water, as in river rowing, "catching a crab" (as the being caught by the oar and thrown back into the bottom of the boat is called) will probably result. In rowing, the oar should be held firmly, but not rigidly. To begin the stroke, the arm should be stretched straight out from the body, which should lean forward so that the oar may enter the water well forward. A firm quick grip should be taken, and kept up in the water. The back should be held straight and square, and the head up. The shoulder and loins should be made to do as much of the work as possible. The higher the boat's side, the heavier will be the work thrown on the shoulders. The legs should take part in the movement, and the feet be placed firmly against the stretcher. The body should work all together like a pendulum. The stroke should be firm and strong throughout, and should end just abaft the athwart ship line of the rowlock, where the oar should be lifted square out of the water, and feathered for the recovery. "Feathering" is often the weak point in rowing; it is a mistake to attempt it until the other details of pulling have been mastered. A common fault is to feather under water. The oar should be lifted well out, and the recovery made as soon as possible.

Sculling is a very useful accomplishment. It is the propelling of a boat by means of one oar placed over the stern (preferably in a rowlock), and worked alternately, first one way and then the other.

THE MARINER'S COMPASS.

All sailors should thoroughly understand the mariner's compass, the most important instrument on board ship. We are only concerned here with the use of the compass for showing the direction of the ship's head, and its action as a guide to the helmsman. We first learn the four cardinal "points of the compass," as N., S., E., and W. are called. They divide the circumference into four quarters; each quarter is divided into eight points (32 in

FIG. 1.



MARINER'S COMPASS.

* I am indebted to Lord Kelvin for the loan of this block. It is a figure of his well-known compass card.

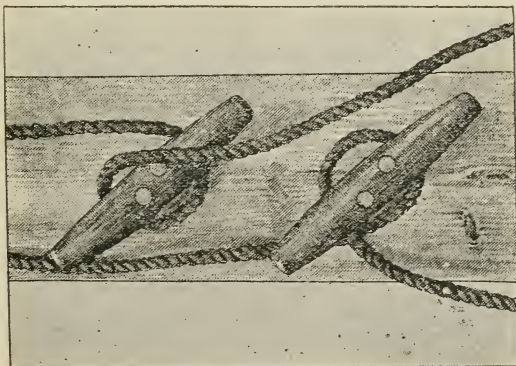
all); and these points, again, are subdivided into half and quarter points. On steamers the circumference is still further divided into degrees, as steering to that precision is quite possible in fine weather. The degrees are 0 at N. and S.; 90° at E. and W. (see figure and table showing points and corresponding degrees). A black streak, called "the lubber's line," is painted on the front inside part of the compass bowl; it is over the fore-and-aft line of the ship, and is for the purpose of showing the helmsman the exact position of her head. "The lubber's line" is extremely useful despite its name, which dates from the days when a ship was deemed to be going satisfactorily if she kept within a point or so of her course; a sailor was supposed to be capable of keeping her so without any reference to the line. In learning the compass, it may be pointed out that N. and S. are more important points than E. and W.; hence the octants are N.E., N.W., S.E., S.W., not E.N., W.N., &c.

Again, the intermediate points are N. by E., N.N.E., N.E. by N., N.E., N.E. by E., and then E.N.E. By remembering this the first learning of the compass becomes more easy.

MARLINE-SPIKE.

The Marline-spike is a particularly useful instrument on board ship. It is a long, pointed piece of steel, with an eye in the end, to which a lanyard is fitted. To keep the spike from banging about when it is being taken aloft, one should put the

FIG. 2.



RIGHT AND WRONG WAY OF BELAYING A ROPE.

lanyard round one's neck, and half hitch it over the point of the spike. As a rule, no instrument or grease-pot should be used aloft that has not a lanyard attached to it.

BELAYING-PINS AND CLEATS.

For the purpose of securing the ends of ropes on deck, "belaying-pins" and "cleats" are used, and the rope is secured to them by twisting and crossing the parts round them, taking care not to take jamming turns. Fig. 2 represents the right way—on left cleat—and wrong way on right cleat—of belaying a rope. It is never advisable to hitch a rope on a cleat or pin.

Pieces of wood holding a number of pins, and fastened to the ship's side, or elsewhere, are called *fife rails*.

WATCHES AND TIME.

The duties on board ship are carried on by means of dividing the ship's company into watches of four hours each, half the ship's company being on duty day and night. Practically every one has four hours on duty and four hours off. To avoid the time on duty always falling at the same hour, the time between 4 p.m. and 8 p.m. is divided into two watches—4 to 6 and 6 to 8—called the "dog watches."

Every half-hour is announced by striking the bell (which is found in every ship, and which should not be less in size than eight inches), the number of times struck being as follows:

0.30 a.m.	}	1 bell.	1.0 a.m.	}	2 bells.
4.30 a.m.			5.0 a.m.		
8.30 a.m.			9.0 a.m.		
0.30 p.m.			1.0 p.m.		
4.30 p.m.			5.0 p.m.		
*6.30 p.m.	}		*7.0 p.m.	}	
8.30 p.m.			9.0 p.m.		
1.30 a.m.	}	3 bells.	2.0 a.m.	}	4 bells.
5.30 a.m.			6.0 a.m.		
9.30 a.m.			10.0 a.m.		
1.30 p.m.			2.0 p.m.		
5.30 p.m.			*6.0 p.m.		
*7.30 p.m.	}		10.0 p.m.	}	
9.30 p.m.					
2.30 a.m.	}	5 bells.	3.0 a.m.	}	6 bells.
6.30 a.m.			7.0 a.m.		
10.30 a.m.			11.0 a.m.		
2.30 p.m.			3.0 p.m.		
10.30 p.m.			11.0 p.m.		

* Dog watches.

3.30 a.m.	}	7 bells.
*7.30 a.m.		
11.30 a.m.		
3.30 p.m.		
11.30 p.m.		

4.0 a.m.	}	8 bells.
8.0 a.m.		
noon		
4.0 p.m.		
8.0 p.m.		
midnight		

The bells should be struck punctually, and in twos, thus 4 bells, is 1, 2 sharply, then slight pause; 3, 4, and so on.

* This 7 bells is often struck at 7.20 a.m., so that the relieving watch can get breakfast before going on duty.

PART II.

ROPES, KNOTS, SPLICING, ETC.

Knots, Bends, and Hitches—Splicing and Netting—To Worm, Parcel and Serve—Masts and Rigging—Fittings of Yards, Gaffs, &c.

ROPES.

UNTIL quite recently all ropes were made of vegetable fibre, which was teased out, and spun up into suitable form by hand or machine; but since the introduction of iron, and particularly of mild steel, rope made of this latter material is rapidly superseding all others, even for the running gear. The vegetable fibre ropes are made of hemp, manilla, or coir. The fibres are first spun into yarns, the yarns are twisted into strands, and the strands into the various forms of rope such as:

Hawser-laid rope made up of three or four strands, twisted up from left to right. If the rope consists of four strands, it has a small strand as a heart.

Cable-laid rope, which is constructed by laying up three hawser-laid ropes from right to left.

Coir rope is made from the fibres of the cocoanut husk, and, as it floats, it is very useful as a laying-out line, as a guesswarp, or for attaching to a life-buoy.

Wire rope of the best class is composed of six strands; in the centre of each of these strands there is a hemp heart; the hearts assist in making the wire more flexible.

Ropes are measured by their circumference.

Wire rope is made in various lengths, other ropes are generally made in lengths of about 112 fathoms. Hemp ropes are usually tarred; manilla ropes are sometimes left white; at other times they also are tarred.

Ratline stuff. This is composed of 18 or 21 thread (18 or 21 yarns) and is the smallest *rope* made; below that there are various

kinds of *line* known as amberline, cod line, marline, and spun-yarn (3 and 2 stranded).

Warps and hawsers are very large ropes, generally cable laid, used for towing and securing ships to piers and wharves. These are now almost entirely replaced by wire hawsers, which are much stronger and more handy.

KNOTS.

A knot is formed either by twisting the ends of two ropes together, so as to secure one to the other, or by opening out the strands of one and forming them into various devices; of the former we have in Plate III., (1) Reef knot; (2) Rope-yarn knot; (3) Turk's head; (4) Figure-of-eight knot; of the latter, in Plate III., (5 & 6) Matthew Walker knot; and in Plate IV., (1) Shroud knot; (2) Single-wall knot; (3) Double-wall knot; (4) Single wall and crown; (5) Double wall and crown; (6) Stopper knot.

Plates III. and IV. will illustrate the formation of these knots better than any description. There are many other fancy forms of knots, but they are not mentioned here because of their unimportance for practical purposes.

Bends and hitches are really kinds of knots which enable two ropes to be attached together; or a rope to be attached to anything else. They are illustrated in Plate V.

Clove hitch is used for rattling down rigging.

Round turn and two half hitches are used for securing a rope to a stanchion or anything else, so that it will not jamb, and also for sending a sail aloft.

Timber hitch is used to tow or lift a piece of timber, or to send down a sail from aloft.

Rolling hitch is used to attach a rope to another, so that it will not slip when hauled on.

Marline-spike hitch is used for heaving, seizings, and such like tight.

Blackwall hitch, for attaching a rope quickly to the hook of a block. Can be doubled.

Marline hitch is used for marling down, parcelling on a rope, or for making a selvagee strop.

Sheet bend, to make a rope fast to the bight of another.

Catpaw, for putting on the hook of a block.

Stopper. A short piece of softened rope, which is used as a preventer on a rope with a heavy load. It is hitched round it, the end is laid along the lay, and held by the hand, in the pauses between the haulings.

Clinch, inside or out, according to the way in which the end is seized. It is used in cases where the rope is required to be let

go, as also when it is necessary to avoid all chances of jamming, as in attaching buntlines to sails.

Selvagee strop. A strop is often used to attach a block to

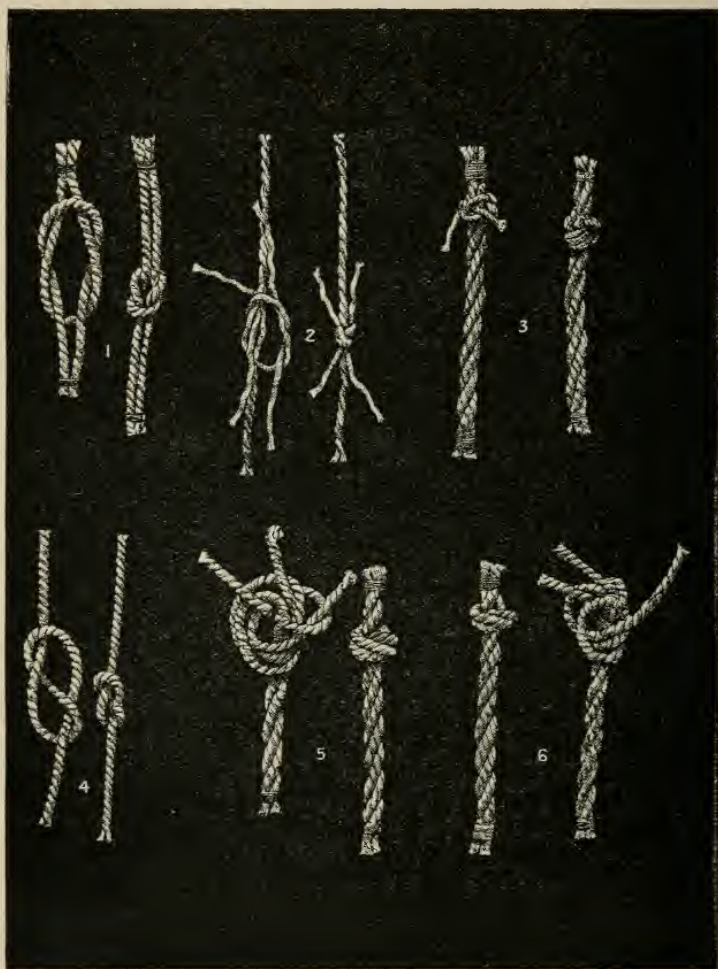


PLATE III.—KNOTS.

1. Reef knot.
2. Rope-yarn knot.
3. Turk's head.

4. Figure-of-eight knot.
5. } Matthew Walker.
6. }

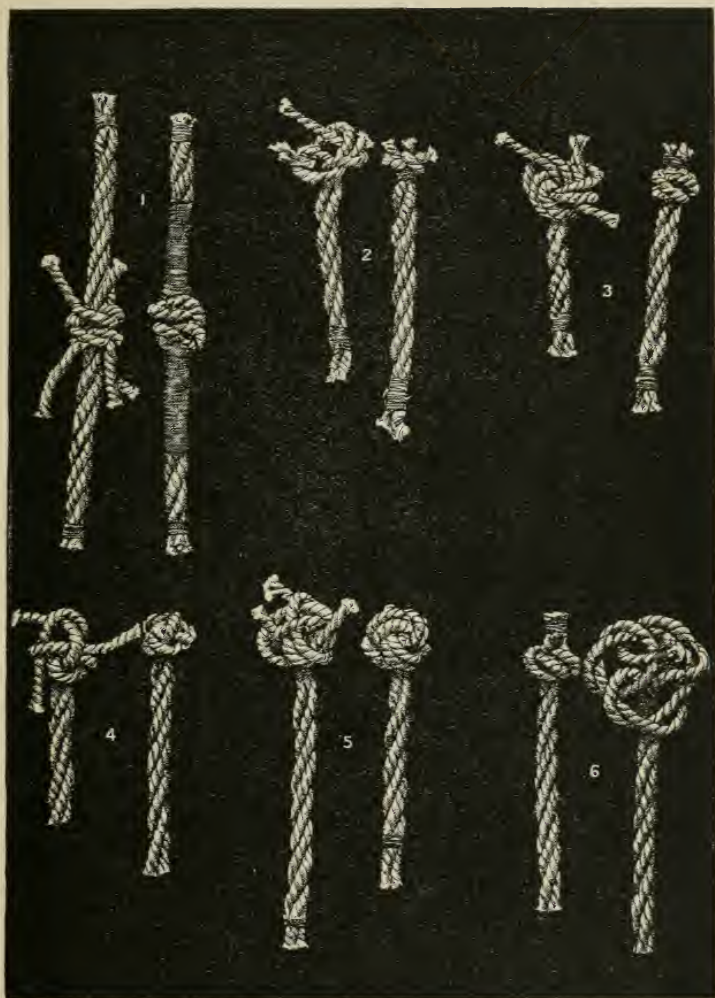


PLATE IV.—KNOTS.

1. Shroud knot.
2. Single wall.
3. Double wall.

4. Single wall and crown.
5. Double wall and crown.
6. Stopper knot.

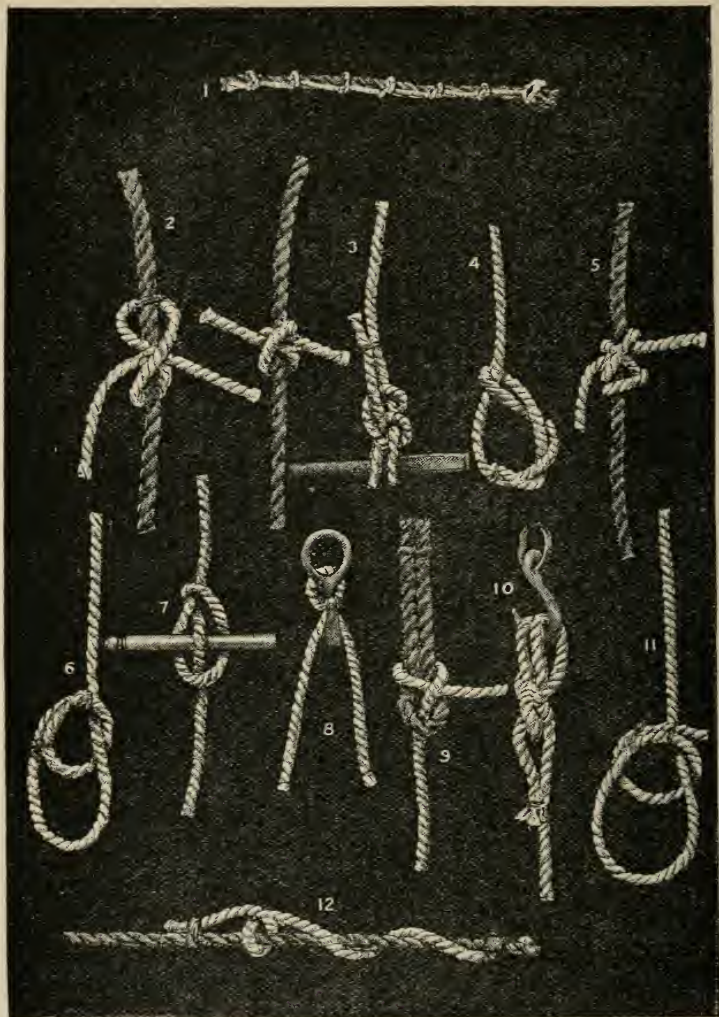


PLATE V.—HITCHES, BENDS AND CLINCHES.

- | | |
|-------------------------------------|-------------------------|
| 1. Marline hitch. | 7. Marline-spike hitch. |
| 2. Clove hitch. | 8. Blackwall hitch. |
| 3. Round turn and two half hitches. | 9. Sheet bend. |
| 4. Timber hitch. | 10. Catspaw. |
| 5. Rolling hitch. | 11. Outside clinch. |
| 6. Inside clinch. | 12. Stopper. |

rigging, or to a rope, such as a tops'l sheet. It is made of good yarns laid round in form of a ring, and marled down with yarns.

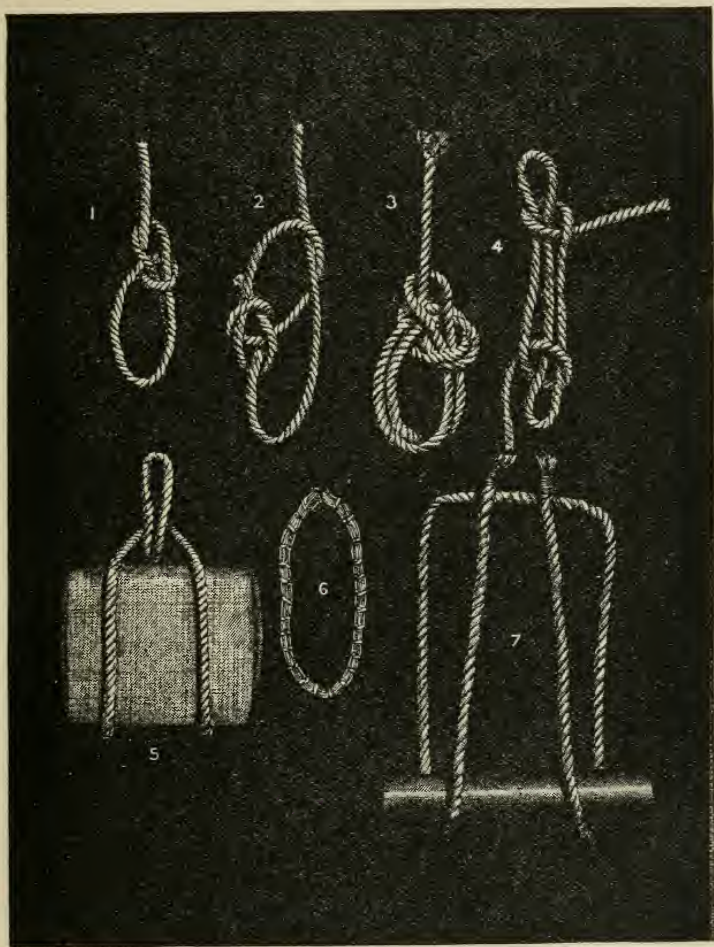


PLATE VI.—BENDS AND SLINGS.

- | | |
|--------------------------|--------------------|
| 1. Bowline. | 4. Sheepshank. |
| 2. Running bowline. | 5. Slings. |
| 3. Bowline on the bight. | 6. Selvagee strop. |
| 7. Parbuckle. | |

It is then twisted round the rope to be hauled on, and the hook of the block is placed into the bight ends.

Bowline is used for sending a man aloft ; making a pair of

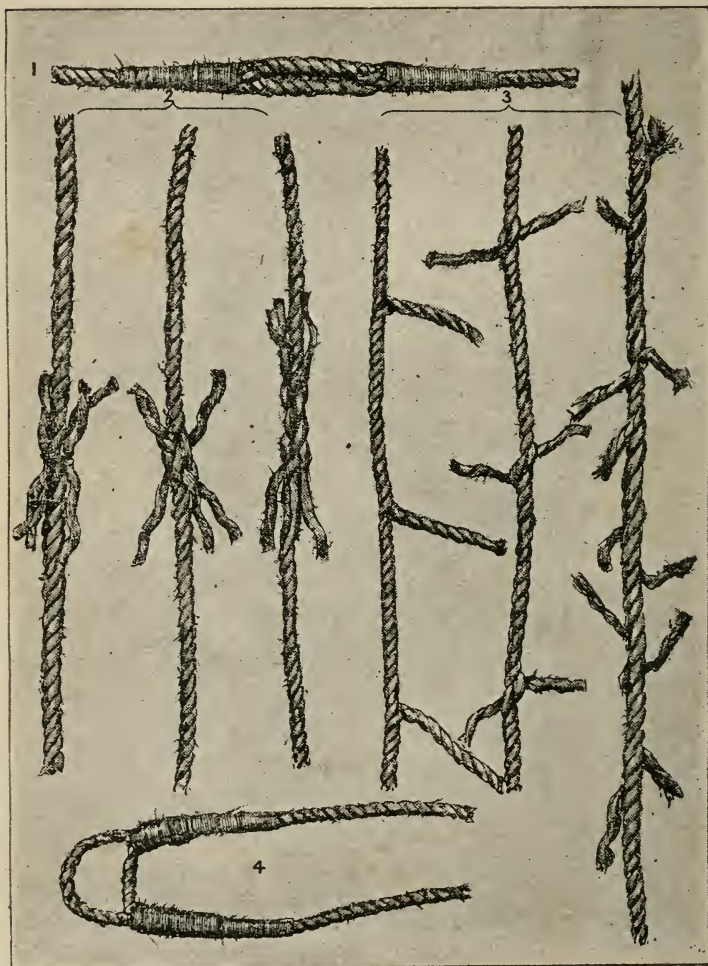


PLATE VII.—SPICES.

- 1. Cut splice.
- 2. Short splice.

- 3. Long splice.
- 4. Horseshoe splice.

slings; bending two ropes together; and for many other purposes. If made on the bight (**bowline on the bight**) it is useful for lowering an injured man from aloft; if fitted as a **running bowline**, for throwing over anything out of reach.

Sheepshank is useful for shortening up a rope.

Slings. A sling is a large strop; it is used for hoisting in casks, cases, bales of goods, or, in fact, anything. They are generally made of manilla. The two parts are passed under the package to be lifted; then one bight (which hooks on to the hook of the tackle) is rove through the other bight and tightened up. As a makeshift a bowline can be turned into a sling at a moment's notice.

Parbuckle. A parbuckle can be used to roll a cask up an incline; to raise any weight, such as a mast, up a ship's side; or to transfer a package from a boat or to a wharf, where no other lifting appliances are available. It consists of two ropes; the ends are made fast at the place to which the weight is to be raised, and the loose ends passed under the package, or other weight, and brought up to the same place. By hauling on these ends, the weight can be rolled or slid up the incline, or skids fitted for that purpose.

Plate VI. illustrates the bends and slings.

SPLICING.

In order to join two pieces of rope together, without appreciably increasing their diameter, an operation called "splicing" is gone through. There are various kinds of splices, viz: **short splice**, **long splice**, **eye splice**, **cut splice**, and **horseshoe splice**. (Plate VII.) The principle in each consists of marrying the strands, thinning them out, and tapering, so that the increase in diameter is only slight. In long splicing, there should be no increase in diameter.

In the **short splice**, the two ends of the ropes are unlaid for a short distance, and the strands of each one brought together so that they interlock or marry; the centre ones are first tucked under one another, and then all the others. After the first tuck of each pair of strands, the strands are halved, and so on, two tuckings from each being ample. In a **long splice** each strand is carried much further back, so that the tucking for each comes wide apart. In cable laid ropes, the process has to be carried out for each strand. Care should always be taken not to waste rope in the splicing.

In an **eye splice** the rope is opened out, and turned over, so as to leave an eye the required size; then the ends are tucked, the

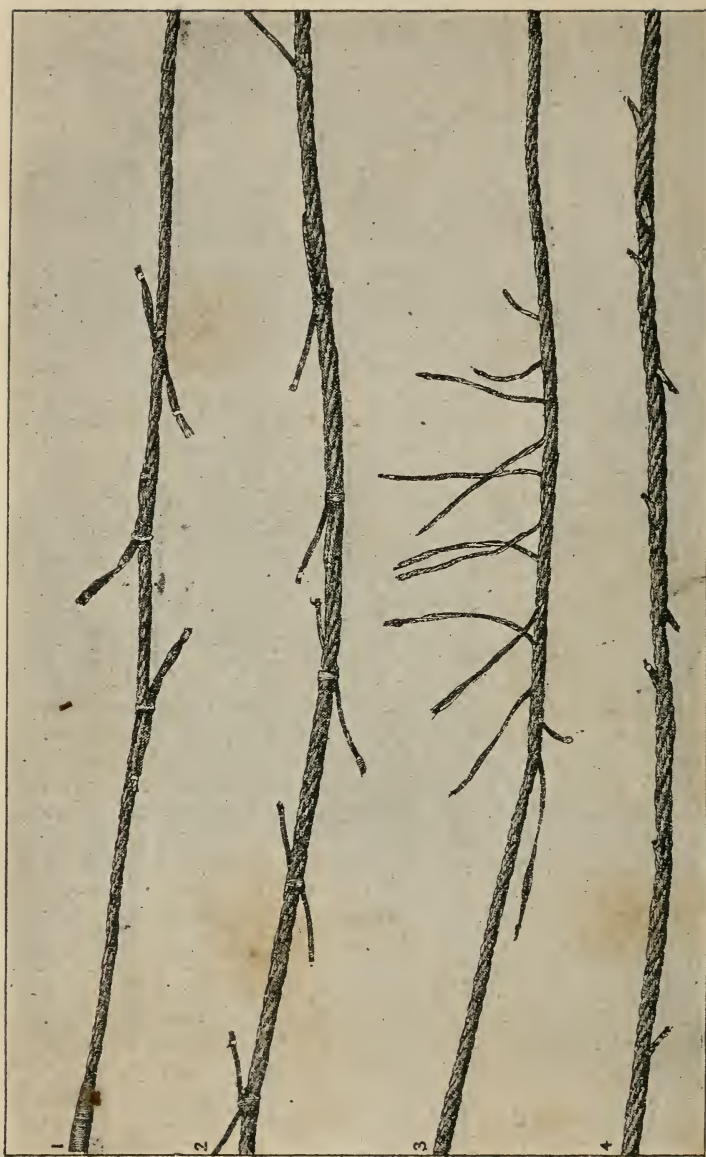


PLATE VIII.—STAGES OF SPLICING.

1. Unlaid in pairs.		2. Unlaid in singles.		3. First tuck.		4. Final tuck.
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middle strand first; then the strand on the left, which has a turn or two taken out of it so as to lie flat (the bight of the eye being held next the splicer), and the strand on the right last. This right strand should tighten up the first tucking.

The cut and horseshoe splices will explain themselves from Plate VII.

Splicing wire rope.—As has been stated, there is a hemp heart in each strand, and a heart the size of the strands through the centre of all. In making a long splice care must be taken to unlay the strands without taking the turn out. It is well to un-

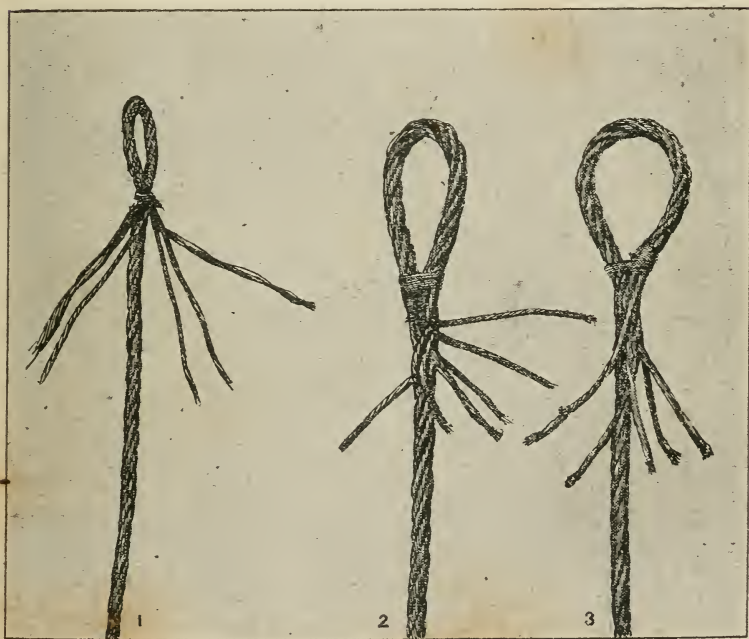


PLATE IX.—EYE SPLICE.

lay them in pairs. The unlaying of each pair can be continued when they are married. At least 3 feet will be required for each strand in splicing a fair sized rope; this will mean 18 feet in all. The rope is first put together as when splicing an ordinary three-stranded rope. Take one pair of strands, unlay them singly, and lay them up clear of each other for splicing, till these six pairs of

ends are at suitable distances apart. Thrust a spike right through the heart of the rope at one end of the splice, leaving three strands to either side of the spike. Pull out the bight of the hemp heart, with another spike, cut it a few inches to either side, and work the two ends of the wire rope into its place. This is easily done by moving the first spike about in its place. Cut the end of the strand you are working on, and butt it against the end of the heart in the centre. Proceed in like manner with all the strands: the parts will then jamb in tightly together, and look very neat. Plate VIII. shows the splice in various stages. In the case of a hawser, the ends of the strands may be tucked once to ensure safety, though this precaution is scarcely necessary.

In making an **eye splice** there are various ways of tucking the ends, but only one will be noticed here. When the size of the eye is determined on, fix a light seizing on the wire, about two feet from the end (Plate IX. 1), unlay the ends to this seizing, and bend the wire to the shape of eye required. Hang this bight up with a piece of line, so that the splicing part comes about level with the chest. Place the main part of wire to the left; divide the unlaidd strands so that three are on the left, and three on the right of the main rope; proceed to tuck the first end on left under two strands of the main wire, and so on with the others (as shown in Plate IX. 2), placing each of the others, however, under one strand only (Plate IX. 3).

Take care to enter all in one way, that they may come out in their proper lay. Haul the strands fairly tight, and hammer them into their places, leaving a small space in the neck of the splice. Then tuck the strands twice under one strand only, taking care not to make the tucks too short, or a lumpy splice will be the result; now halve the strands, and tuck once.

Remember that the neatness of a splice depends a good deal upon the manipulating and humouring of the strands.

When the ends are cut off, a judicious application of the spike and hammer will finish the splice, which should then be parcelled with oiled canvas, and neatly served over. Amber line should be used for this purpose for large ropes.

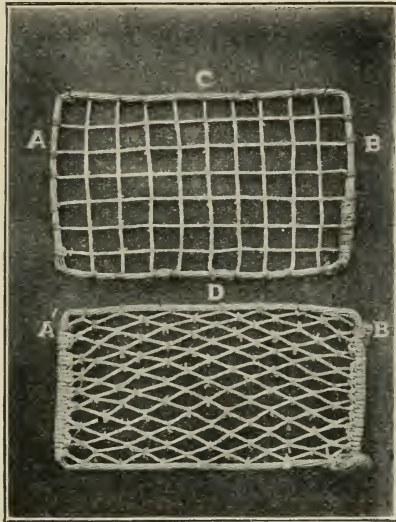
NETTING.

Nets are either "made" nets, or "worked" nets. The former can be made on deck, by enclosing a space in the shape desired with wire. To form the mesh, ratline (or other small stuff) is stretched across the enclosure at proper distances, first in one direction, from A to B, Fig. 3, then in the opposite direction (C to D), care being

taken to keep the spaces equal. The crossings are secured with twine seizings.

Another, but a weaker method of net-making, is to draw the parts into the heart shape, and seize them, as in Fig. 3.

FIG. 3.



NETS.

Worked nets are manufactured by means of needle and mesh, and are made of fine stuff.

Nets are fitted under the jib-boom for the jibs and over the bowsprit for the stays'ls to aid the stowage of these sails.

SENNIT.

Sennit is a plaiting of any number of yarns, from three upwards. It may be flat, round, or square in form, the flat form being most adaptable for general use. Sennit is made of yarns. It is used chiefly for chaffing gear, gaskets, &c. In working, the material should be held in the left hand, while the right lays in the plaits.

TO WORM, PARCEL, AND SERVE.

To "worm" a rope, first take some yarn, or a small line, and

FIG. 5.



PARCELLING A ROPE.

FIG. 4.



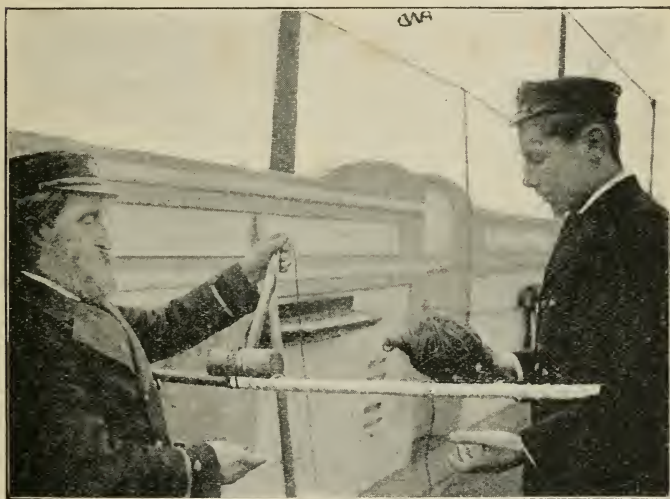
TO WORM A ROPE.

with it fill up between the lay of the rope to be worked over, working with the lay, so as to level all inequalities (Fig. 4).

To parcel, take some strips of tarred canvas (pieces of old sails or awnings) about $1\frac{1}{2}$ to 2 inches wide, rolled bandage-wise, lay it over the rope and worming, working up with the lay. Each turn of the canvas should slightly overlay the one that went before (Fig. 5).

To serve. Work spun yarn (or other small line) over the parcelled rope in the opposite direction to the lay, using a serving mallet for the purpose. Unless a patent mallet is used, two

FIG. 6.



SERVING A ROPE.

operators are required to serve a rope, one to work the mallet, the other to pass the ball of small line (Fig. 6). The operator passing the ball must take care to keep turns out of the line as passed.

Service is chiefly used for covering splices, working on foot-ropes in the wake of the stirrups, in the eyes of rigging, and in many other places. Formerly the rope rigging was, as a rule, served all over; as also was wire rigging, till quite recently; but the utility of the operation in the latter case being doubtful, wire

rigging is not served now. Sailors have a little doggerel rhyme, which will help the student's memory. It runs thus :

Worm and parcel with the lay,
Turn round and serve the other way.

MASTS AND RIGGING.

Masts are secured by means of wire ropes, called **rigging**. At a certain distance from the mast-heads strong pieces of wood or iron, called **trestle-trees**, are bolted on in a fore-and-aft direction, and are supported from below by extra flange-pieces, called **hounds**, and **cheeks**, bolted on to the masts. On the trestle-trees transverse pieces are bolted, called **cross-trees**. The trestle-trees take the weight of the mast above, and the cross-trees make a platform, which is generally covered over on the lower mast, and left open on the top-mast; they also form a means of spreading the top-mast rigging. The **lower rigging** is put over the mast-head in the following order: the first pair of starboard shrouds, the first pair of port shrouds, the second pair of starboard shrouds, and so on; and last of all the stay. Many ships have **cap shrouds** and **cap backstays**, which shackle on to bolts in the cap, and help to support the mast where the strain of the lower yard comes. Top-masts and spars above are fitted with backstays in addition to shrouds. Spars of iron or wood, called **outriggers**, are fitted to project out from the top-mast crosstrees, to assist in spreading and keeping in their place the t'gallant and royal backstays. The lower shrouds and all backstays are set up to the rail of the ship by means of **deadeyes**, or **screws**, and the stay by means of **hearts** and **wire lanyards**. The **stay** is set up first, then the **shrouds** and **backstays**. The foremost shroud of the lower rigging is known as the **swifter**. (See Plate II.)

BOWSPRIT, &c.

In all modern ships the long bowsprit, jib-boom, and flying jib-boom, with their accessory gear of dolphin striker, and whiskers, have been shortened into what is known as the **stump bowsprit**, which is really an integral part of the bow of the vessel. It is securely bolted thereto, and further held in position by means of an iron band, called the **gammoning**, on the inboard end, secured by means of iron stays (called **bobstays**) and shrouds at the outboard end. The bowsprit is intended for the purpose of setting up on it the fore-t'gallant and royal stays, and also for spreading the head sails, consisting of the foretop-mast stays'l, inner and outer jibs. The

forestay and **foretop-mast stay** are set up to the knightheads; the foretop-mast stays'l stay, inner and outer jib stays, t'gallant and royal stays on the bowsprit.

The lower masts, top-masts, and bowsprits are now generally made of steel; the two former are frequently all in one piece.

FITTINGS OF YARDS AND GAFFS.

Yards.—The lower yards are fitted with **trusses** and **truss bands**; **slings** and **sling bands**; **tops'l sheet lead bands**; **yard arm bands for lifts**, **braces**, **footropes**, and **jackstay bands**. Sometimes two jackstays are fitted, one for bending the sail to, and the other for holding on to. The jackstays are rove through bolts in the bands. Eyebolts are fitted either at the yard arm, or in slings, for clew garnets. The footropes make fast to one of the truss arms amidships, or to an eyebolt at the yard arm, and are supported in places by **stirrups** (short pieces of rope attached by one end to the jackstay bolts with seizings, and having an eye at the other end through which the footrope is rove). Footropes and stirrups are now generally made of wire, as are also brace pendants and lifts. The slings are made of chain and the truss of iron.

Lower lifts are rove through blocks at the mast head, and are then fitted with tackles which can be slackened up or hove taut on deck. Other lifts shackle to strops or bands fitted to the mast heads, and to eyebolts on the yard arms. Lower tops'l and lower t'gallant yards are hung from their respective caps by means of a crane (which takes the place of a truss and slings in the lower yard), and their lifts are shackled on some little distance inside the yard arm, and are unshackled when at sea.

A tub or parrel is fitted on the upper tops'l and other hoisting yards; its purpose is to facilitate the hoisting and lowering of the yards by means of the **halliards**, as the arrangement of ropes and tackles for setting the sails is called, and to keep the yard to the mast.

Braces are fitted with blocks and wire pendants to the yard arm, a runner being rove through the block. In the case of tops'l and lower yards all parts, except the standing part of the upper brace, lead to bumpkins at the ship's side, or just inside the ship's rail. Sometimes the standing part of the fore lower tops'l brace seizes on to the main stay just under the main top.

Gaffs are sometimes fitted so as to be fixed in position, and are sometimes made to work up and down the mast on an iron jackstay.

In the first case there is generally a piece of iron called a **goose-neck**, which is jointed and fits into a stationary iron on the mast,

just under the top ; the free end is held in place to a bolt, on or near the cap, by a chain lift. In the second case, the gooseneck fits into a sliding piece of iron called a **shoe**, which works up and down on a jackstay, on the after part of the mast. Underneath the gaff there is generally another jackstay, to which the sail is attached by means of hanks. When it is necessary to take in the sail, by the downhaul and brails, it is hauled down against the mast, to which it is made fast with gaskets.

Where a **spanker boom** is fitted there is a gooseneck at the mast, the free end is supported by lifts, and is controlled by sheets.

Gaffs are fitted with **vangs** to steady them sideways.

WHIPPINGS.

Ordinary Whipping.—In this several turns are taken with the twine round the end of the rope ; then turns are taken on the bight over the end, which, when hauled tight, jams itself.

Sailmaker's Whipping.—In this the twine is wound round the rope on its end, for about a dozen turns ; the end is then passed through between each strand across the seizing with a needle, so jamming the whole together and making it very compact.

The ends of all earings, gaskets and awning stops should be whipped with this kind of whipping.

West Country Whipping.—Place the middle of the twine against the rope and take turns round the rope with both ends, making a half knot at each half turn, then finish off with a reef knot. It is useful for marking braces, &c.

PART III.

GEAR, LEAD AND LOG, ETC.

Running Gear—Seizings—Lead and Log—Spanish Windlass—Blocks—
Tackles and Purchase.

RUNNING GEAR.

Running gear is fitted to sails to set and take them in. It is called **running** because it is movable, in contradistinction to the fixed gear, or **standing** rigging. The principal running gear are buntlines, and spilling lines, leech lines, slab lines, clew garnets and clew-lines, tacks and sheets, bowlines, reef-tackles, downhauls and outhauls, brails and tripping lines, halliards and tyes, and braces.

Buntlines are rove down before the yard, and clinch on to thimbles in the foot of the sail.

Spilling lines often replace buntlines. They run through the bull's-eyes in the foot, and go right round the sail. The buntline or the spilling line is the most effective gear for keeping the sail quiet.

Leechlines are often double ; they lead in a similar way to the leech of the sail. In big single t'gallant sails the leechline goes right round the leech.

A **slabline** is sometimes fitted to the centre of the foot, on the after side of a course, and is attached by a clinch. It is useful when the mains'l is just tripped up for working ship. The clews of sails are hauled up by means of **clew garnets**, or **clewlines**, fitted double in courses and lower top-sails. They are called clew garnets only in the case of the courses. Above these sails they are clewlines. They are generally fitted to haul the clew of the sail up under the bunt. It is now becoming usual to clew up to the yard-arms.

Courses are set by means of **sheets** and **tacks**. A single tack and a double sheet are fitted to each clew. To set the sail properly, a wire or chain pendant is hooked into the tack clew from the deck ;

it is hove down tight by means of a tackle or winch. The single line acts as a lazy tack.

Sheets are fitted only to sails above the courses; these sheets are of chain, in the wake of the yard, and are led through a sheave at the yard-arm, along the under part of the yard, again through a sheave under the bunt of the yard, and thence on deck.

Bowlines are attached to the weather leech of courses, to haul it well forward, being rove through a lizard fitted on to the bowline bridles.

The upper top-sail clews, and the upper t'gallant clews are secured to the yard-arms by small pieces of chain, or by long shackles, as these sails are never clewed up.

Clewlines and **buntlines** are led down on deck amidships; and those of t'gallant sails and royals to the ship's side.

Reef-tackles are fitted to square sails, to haul the leech up to the yard when the sail is to be reefed, so as to ensure that the reef earing can be hauled quite home, and that the points can be tied properly.

Fore-and-aft sails, such as trysails, spankers, and drivers, are fitted with **downhauls** and **outhauls**, for hauling the head of the sail up and down the gaff; and with **brails** for taking the sail in. The downhaul and the outhaul are seized to the peak thimble; the brails are middled, and the bights seized on the after leech of the sail, so that a part of the brail is on either side of the sail; each part is led to the deck through a block lashed to the jackstay on the mast.

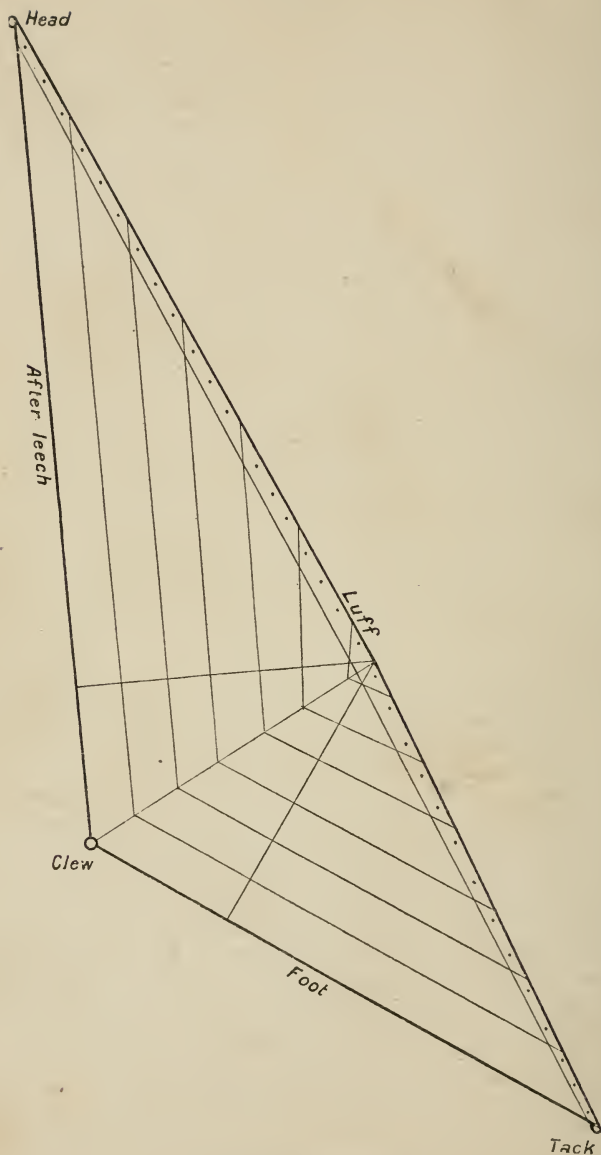
In addition to halliards and downhauls, stays'ls are often fitted with **tripping lines**, useful for lifting the clews over the stays on change of tack. Jibs and head-stays'ls are fitted on each side with a sheet. Staysail and jib sheets are fitted with a wire pendant, through the block of which a whip is rove. Other fore-and-aft sails have only one sheet, shifted from side to side. When a sail is set, the buntlines, leechlines, spilling lines, and downhauls (upper yards) should be carefully overhauled, and stopped with twine to prevent their chafing the sail. Gaskets should be made up and stopped to the jackstay, with the same view.

Sails are generally carried as long as possible, and as there is less danger of their splitting when on the stretch as set than when slack and banging about, the gear should be fitted so as to snug up the sail as quickly as possible. In this operation the gear must be carefully placed. Useful assistance may be given by the helm, or by trimming the yard.

Fig. 7 shows the fitting of the gear on a course.

Figs. 7 and 7A also show names of parts of square sail, and of a fore and aft sail.

FIG. 7A.

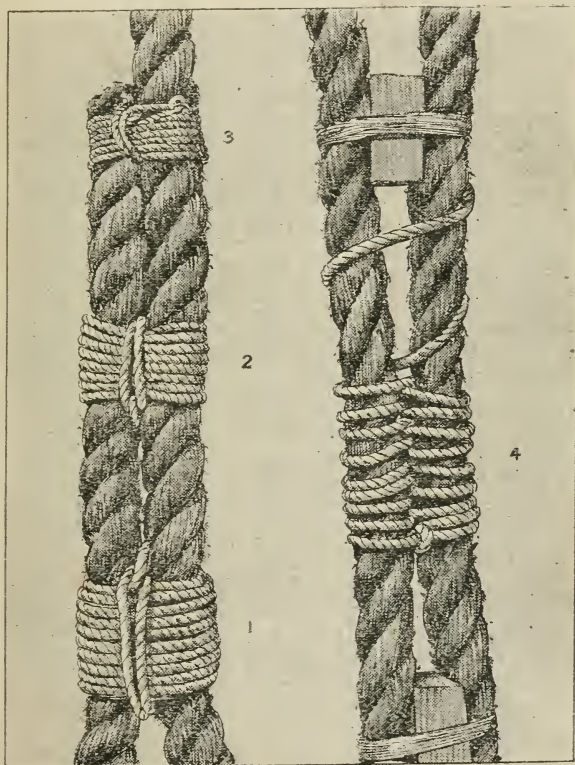


FORE-AND-AFT SAIL.

SEIZINGS.

Seizings are used for securing the parts of a rope together side by side, as in stropping a block, making an eye in the bight of a rope, or in making an eye in the rigging for putting over the mast-head.

FIG. 8.



SEIZINGS OF ROPE.

The principal seizings in use are the **throat** (1), **quarter** (2) or **round end** (3), and **racking** seizings (4). The **throat** and **quarter** are elaborated **end** seizings. **Racking** seizings are used for racking two ropes together to keep them from slipping. The

same name is given whether the seizing is made of hemp or of wire. The **quarter** or **round** seizing (Fig. 8) is made as follows : Take a piece of amber line and splice an eye in it ; place it round the parts to be seized, and reeve the end up through ; then take from six to ten turns round the parts of the rope, heaving all well tight ; then bring up the end through the end bight, take two riding turns, heave all taut, and pass the end through riding turns to form a reef knot. In the throat seizing riding turns would be taken.

LEAD AND LOGSHIP.

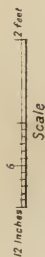
Lead lines are generally made from a special kind of cord which is water laid. Marks are made on the deck, one fathom apart, either by nails or paint. The line (after being well stretched and soaked, and having an eye, eight inches long, spliced in its end) is marked off in length. The bight of the eye is laid against one of the marks, and the line measured off from it, and marked as follows.

1 fathom, deep.	10 fathoms, piece of leather with a
2 " piece of leather with	hole in it.
two ends.	11 " deep.
3 " piece of leather with	12 " deep.
three ends.	13 " piece of blue cloth.
4 " deep.	14 " deep.
5 " piece of white calico.	15 " piece of white calico.
6 " deep.	16 " deep.
7 " piece of red bunting.	17 " piece of red bunting.
8 " deep.	18 " deep.
9 " deep.	19 " deep.
20 fathoms, piece of cord with two knots.	

No marks are put at the "deeps."

The line is marked with different kinds of stuff, so that the marks may be distinguished by touch at night time, when it would be impossible to see a colour. The length of a **hand lead line** is from 25 to 30 fathoms. The lead used with it weighs from 7 lbs. to 14 lbs. A hollow is scooped out of the lower end, into which a mixture of tallow and flour, called **arming**, is put when in use. The mixture secures and brings up a specimen of the sea bottom, unless it happens to alight on hard rock. A becket is fitted to the top of the lead, by which to attach it to the line. A **deep sea lead** weighs 28 lbs., and is similarly fitted to the hand lead. The length of line is 100 fathoms. Up to 20 fathoms it is marked in the same manner as the hand lead ; from 20 fathoms the knots are added in the proportion of 3 knots for 30 fathoms, 4 knots for 40 fathoms, and so on, up to 10 knots at 100 fathoms. At each of the intermediate 5 knots, 1 knot only is placed.

FIG. 9.



SOUNDING MACHINE.

A. Slot for slipping in spindle of drum. B. Pin to hold in spindle of drum. CD. Drum on which wire is wound, and which is exactly one fathom in circumference. F. Handle with which to wind in wire. G. Break flange. H. Weight controlling break. I. Swivel wheel to lead wire over ship's

side. J. Wire guard with pin K, to prevent wire jumping the lead.

The whole apparatus turns round on the stanchion L, M, and can be unshipped. On the side opposite to the handle is fixed an indicator to register revolutions of the drum. By substituting a log ship for the lead, the wire can be used as a Log Line.

It is usual to fix some place at the side of the ship, where the **leadsman** (as the person heaving the lead is called) can take up his stand, and have a clear space for heaving the lead properly. In taking up this position, see that the line is coiled up clear for running, hold it in one hand, and grasp it with the other, about two fathoms from the lead. Swing the lead backwards and forwards two or three times, then, when on the forward swing, let go; it will fly well out ahead, and the line will uncoil from the other hand at the same time.

The coil should be held in the left hand, and the lead hove by the right hand, when standing on the starboard side of the ship; and *vice versa*, when on the port side. Sing out the soundings so as to be heard by the officer on watch. The leadsman can tell instantly by the feel of the line when the lead touches the bottom. The soundings are announced in a sort of singing way, thus: Suppose he finds a depth of 7 fathoms he calls out, "by the mark 7." If 8 fathoms, "by the deep 8." If $9\frac{3}{4}$ fathoms he calls, "a quarter less 10," and so on.

There are many patent sounding machines in the market. A very simple one, the extreme usefulness of which has been proved by practical tests, is illustrated here (Fig. 9). The line is of steel wire, the lead is an ordinary one. The apparatus can be modified in size, and other particulars, to suit different circumstances, but these modifications do not alter the nature of the instrument (see Appendix).

The gear of this sounding machine is handy for use with the ordinary **Log Ship*** (Fig. 10). A log ship (2) replaces the lead and the apparatus becomes an ordinary log line, on the following plan. A line is attached to each corner of a piece of wood shaped like 2, figure 10. A plug, which can be withdrawn, is fitted into one of the corners. The bottom is leaded, so that the wood floats upwards, a sand glass (3) is used which runs to 28 seconds. The problem is, to mark the line in the same proportion of a knot as the sand-glass is of the hour. The question is as follows:

seconds		seconds		feet		
3600	:	28	:	6080	:	x

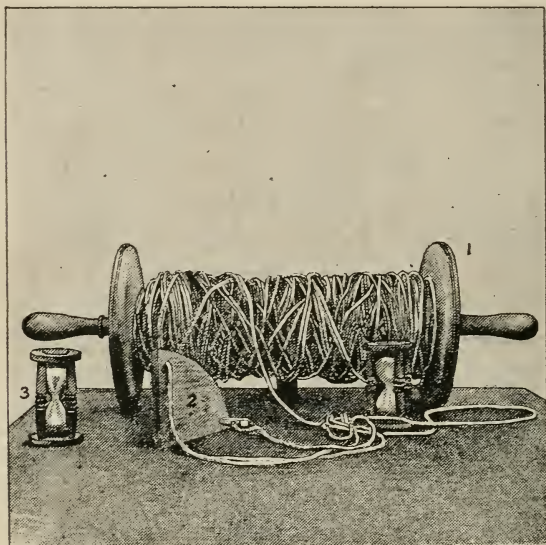
x being the length on the log line required to represent a knot. A certain portion of the line (1), called the **stray line**, is first marked. Its purpose is to allow the log ship to get clear of the ship's wake.

The line is then marked to the length x , which is equal to 47'3". One knot at $\frac{1}{2}x$, one knot at x , 1 knot at $1\frac{1}{2}x$, 2 knots at $2x$, and so on.

* In which case the distance is read off on the counter in fathoms.

If the ship is going at a rate exceeding 5 knots per hour, a 14-second glass may be used. In this case, the number of knots run out must be doubled.

FIG. 10.



LOG LINE, ETC.

Log lines should be wet before they are marked.

Patent logs, which are those in general use, have dials, which indicate the distance run, fixed on to the rail of the ship. The hand log is often of great service, and when it is run from the sounding machine, there is no difficulty in taking rapid observations with it.

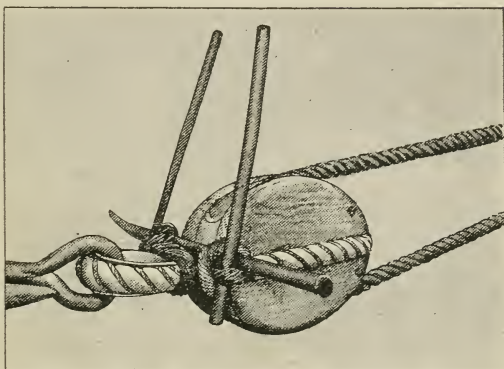
SPANISH WINDLASS.

A **Spanish windlass** is very useful for drawing the parts of a block strop together, in order to get the seizing on properly; also for setting up t'gallant rigging, and for many occasions where it would be difficult to rig a tackle.

A strand is taken and knotted at the end to form a strop. The strop is taken round the parts to be drawn together; and the

bight ends are brought up to a bar on either side. A bar or spike is placed in these bighted ends which are hove round the

FIG. 11.



SPANISH WINDLASS.

bar and thus the parts are drawn together (Fig. 11). There are diverse methods of applying a Spanish windlass. The above are general principles which can be modified to suit different cases.

BLOCKS.

Blocks are stropped, or strapped, by fitting a rope round them, and either splicing the ends, or making a grommet. The former is the method more generally used; the latter makes the neater job.

To **strop a block**, take a piece of rope the required size, cut it so that its length is once and a half the round of the block in the stropping groove or score. Short splice the ends, and take care to put the block into the rope the right way.* Place the thimble, draw the parts of the strop together between the thimble and the block with a Spanish windlass, and put on the seizing. The whole should be kept on the stretch by means of a line rove through the block, the thimble end being seized to something. A piece of old canvas should be placed over the groove of the thimble (to save the rope from rust). Strops are often wormed, parcelled, and served before being placed on the block.

To Fit a Grommet Strop.—Unlay a strand from a rope, make

* Into the largest part of the sheave hole next to the seizing.

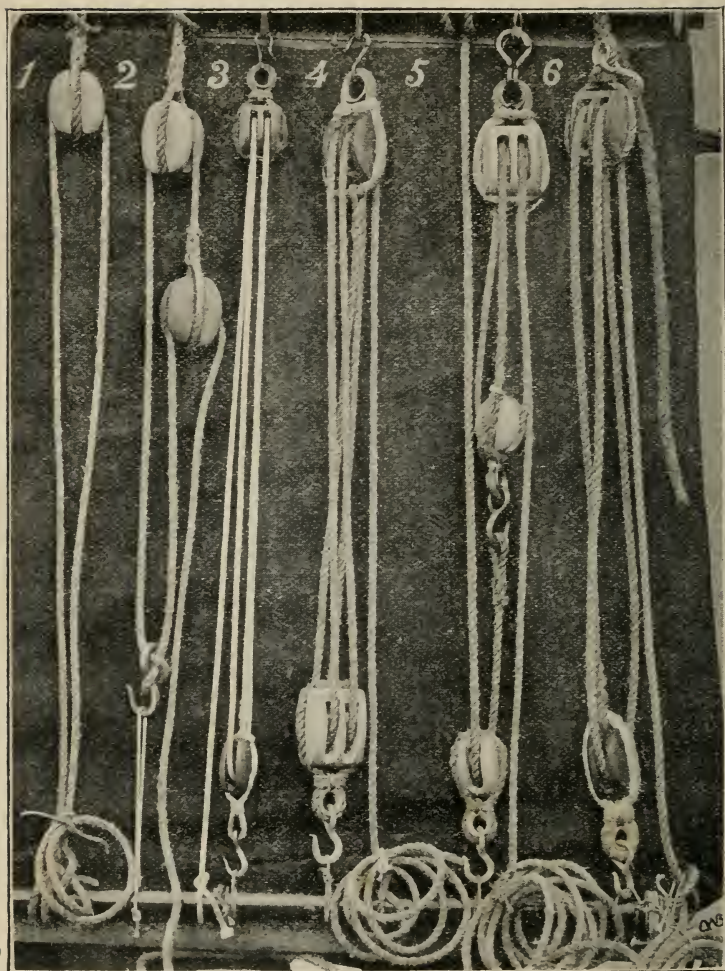


PLATE X.—TACKLES.

1. Single whip.
2. Spanish burton.
3. Tackle.

4. Luff tackle.
5. Runner and tackle.
6. Handy Billy.

a strop of it by laying it up on itself and tucking in the ends. Then proceed as with a spliced strop.

Stropped blocks have fallen a good deal into disuse, as blocks are nowadays fitted internally with iron bands; and many are entirely composed of iron.

TACKLES AND PURCHASES.

These are combinations or systems of blocks and line, by which the power of lifting a heavy weight is greatly increased, the increase being in proportion to the number of sheaves in use.

The moving part of the rope is called the **fall**. The part made fast is the **standing part**, and the hauling part is the **running part** or end.

A single block forms a lead for a rope. The addition of a second block forms a purchase. Every additional sheave next the weight through which the line is passed decreases the power required about one half. For example, in a luff tackle, a weight can be lifted by a weight about a quarter as heavy as itself. In a three-fold purchase one-sixth the weight will do it, and so on. To ascertain the purchase required to lift a weight, knowing the power available, divide the weight to be lifted by the power; the result will be the number of parts of rope to go to the lower block. For instance, suppose 20 tons are to be raised and that there is an available power of 3 tons, divide 20 by 3; the result is $6\frac{2}{3}$; hence 7 parts of the rope must go to the block near the weight. It will be necessary to have a three-fold purchase, with the standing part made fast to the lower block (the one nearest the weight). As each part of the rope will have to bear a weight of about $3\frac{1}{2}$ tons, its size can be judged accordingly.

PART IV.

A.—RIGGING, ANCHORS, ETC.

Rigging—Rattling down—Anchors and Cables—Anchoring—Laying out an Anchor—Sending Yards up and down.

RIGGING.

It is seldom necessary to fit rigging at sea; but it is desirable that an officer should know how to do it, in cases of emergency, when, in consequence of accident, a ship arrives in a foreign port completely dismasted, and has to be entirely refitted there. It is not difficult to cut out shrouds, when we know the drift from the mast-head to the dead-eyes or screws. Care must be taken as we work aft to allow for the extra drift required, in consequence of the eyes of the shrouds lying one over the other. It only takes a simple calculation to determine the drift, when the height of the mast-head from the deck is known. The shrouds can be prepared as quickly as the masts can be made ready for them.

When the shrouds are cut to the required length, fit them in pairs. The bight forms the eye which goes over the mast-head. Proceed to splice the ends round the dead eyes, or into the heart of the screws. Each pair of shrouds should be carefully marked with a canvas tally, as they are finished. The shrouds are sometimes served all over, but this is absolutely necessary only in the eye, and over the splices. Good three yarn, spun yarn, or amber line should be used. A coating of tar will prevent rust. Plenty of room must be allowed in the eyes that go over the mast-head. The parts should be well seized together with a throat seizing (Fig. 8), which ought to come well below the bolsters. If a shroud is found to be too long, or too short, when the rigging is finished, corrections may be made by putting in, or taking out, a turn.

The knot in a rope lanyard, and the splice which fixes the wire lanyard to the upper dead-eye, should come under the spliced end of the shroud, where dead-eyes are used.

Stays are double in lower masts. They are generally set up with hearts and lanyards, and fit round the mast-head, as a rule, over the shrouds. The after-part of the bight comes halfway up the mast-head to its position, where it rests on a strong cleat. For convenience in placing, stays are often fitted with lashing eyes abaft the mast, and after this is secured are then set up with the lanyards forward. The serving is the same as in shrouds. A large mat should be put in the lower stays, in the wake of the belly of the course, to save the sail from being chafed. The stays of lower masts and topmasts set up to the deck, t'gallant stays to lower mast-heads, and royal stays to topmast cross trees.

There is usually an extra topmast stay to carry a stays'l. **Battens** are also fitted on the foremast shrouds, and on the lanyards, to avoid chafing from the foot of the course when sheet is aft.

SETTING UP RIGGING.

To set up lower rigging with lanyards, first secure the stay and get the mast right for rake, then start on the starboard foremast pair of shrouds and work aft in the order in which they have been put over the mast-head. The mast coat* will be a guide as to the uprightness of the mast. A runner and a tackle are generally used for setting up. They are fitted in the following manner (*see Fig. 12*):

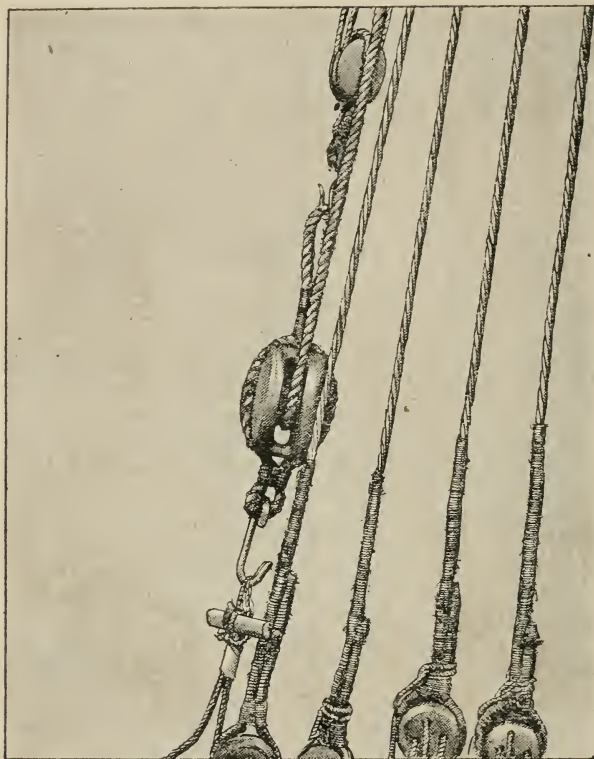
Prepare a luff tackle, a selvagee strop, a piece of round wood (about a foot long) for a toggle, a runner, and a strop for the mast-head. Secure the strop under the top; hook to it one of the hauling blocks of the tackle, and overhaul the other block down. Make fast the standing part of the runner some little distance up the rigging, and attach the lower hook of the luff tackle to the other end of the runner. Take the round piece of wood known as a "toggle," and make a couple of turns with the lanyard round the toggle. Wrap a piece of canvas about the two parts of the lanyard underneath, place the selvagee strop round this, and then hook the runner block on to it. Next proceed to set up, and take the end of the luff tackle to the winch or capstan; if these are wanting another tackle must be put on to get the necessary purchase.

The lanyard should be well greased before setting up. One hand should be ready with a spike to work the lanyard about to help it to render well.

* The *mast coat* is canvas fitted round the hole in the deck through which the mast goes, in order to prevent water going below.

T'gallant rigging can be set up with a Spanish windlass; and topmast rigging with a tackle, or a Spanish windlass.

FIG. 12.



SETTING UP RIGGING.

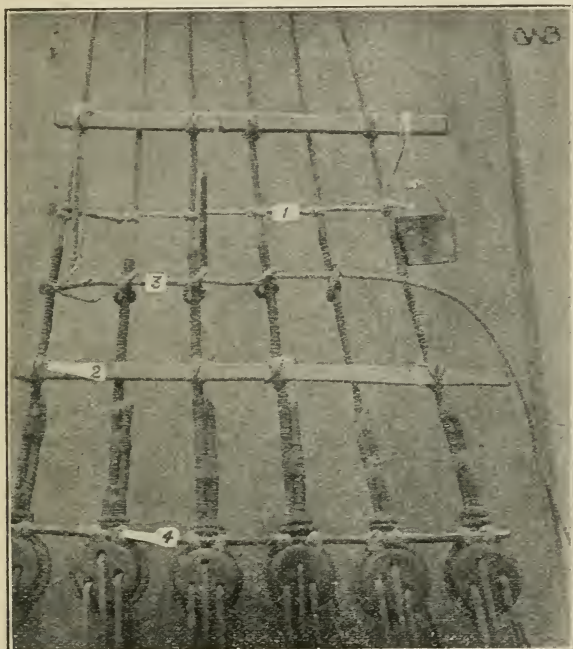
All that is necessary in setting up with screws is to take off the canvas covering, put the bar in tube, and screw up.

RATTLING DOWN.

As an example the Port main rigging will be taken. First stretch well the coil of ratline stuff. See that the sheer pole, (Fig. 13 [4]) from which all the measurements are taken, is

properly fixed in the rigging, exactly in a line with the sheer of the vessel. Then, by means of a line, (1) slightly swift in the rigging at intervals. Next lash some spars (2) (oars are capital things for the purpose) across the rigging, five feet apart, measuring from the sheer pole. Be careful to have the forward ends of

FIG. 13.



RATTLING DOWN RIGGING.

the spars close to the swifter; or a hole will soon be made in the mains'l. The apparatus required will be a marline-spike, some small seizing stuff, a grease pot, a tar pot, and a measure for taking the distance between the ratlines.

The measure must be 15 inches, as that is the usual amount of space between the ratlines. All these implements should have lanyards attached to them. Take one end of the ratline stuff (which should be coiled on deck by the after part of the rigging) up the after part of the rigging. Stand on the sheer pole, and

loosely clove-hitch the ratline stuff from the after-shroud but one to the foremast shroud ; then make a small eye splice in the end of the stuff ; and seize with a plain or cross seizing to the shroud, 15 inches from the sheer pole (Fig. 13 [4]).

Heave the turns well tight, and work aft with the clove-hitches all in the same direction. At the last shroud cut the end, but leave a length sufficient to make an eye splice to seize on to the shroud.

Hitch the end of the stuff above you for the next ratline. Be careful to measure the height at every hitch and seizing. Nothing looks worse than badly rattled down rigging. Remember always to clove-hitch roughly from right to left, then work back from left to right. This method saves ratline stuff and tightens up the hitches in the best way.

The first five ratlines up are generally iron bars fitted to the rigging. On some ships the space between one pair of shrouds is rattled down with wooden bars all the way.

Every fifth ratline is called a **catch ratline**—and is continued to the after-shrouds. In some cases only every fifth ratline is taken to the foremast shroud.

ANCHORS AND CABLES.

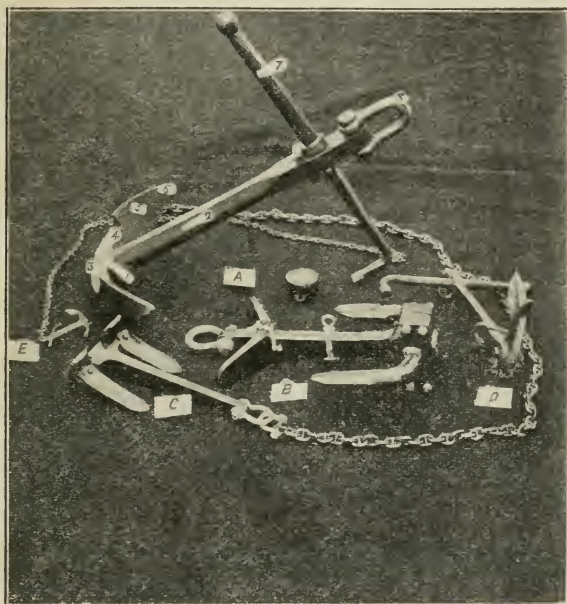
An anchor and a cable are used to secure a ship in a harbour or roadstead. There are different kinds of anchors, ranging from the ordinary old-fashioned form, to the modern stockless anchor, which is rapidly coming into favour, owing to the ease with which it is stowed. See Fig. 14 for the names of the different parts of the anchor.

The **Chain-Cable** is shackled on to the ring of the anchor. It is composed of 8 lengths of chain ; each length measures 15 fathoms, making 120 fathoms in all. The chain is brought in through the hawse-pipe, carried over the special barrel of the windlass or capstan, and then to the chain locker below formed by closed-in spaces amidships. The chains are stowed here when not in use. The end is made fast to one of the frames or floorplates, to secure the end from running out. All anchors and chains are subject to inspection ; they are supplied to ships according to their size.

In addition to the two bower anchors, there are always on board ship at least one spare bower anchor, one or two stream anchors (a smaller kind, useful for heaving a vessel off should she get aground), and several kedge anchors. A ship always carries a certain amount of stream chain, for moving her and for use with the smaller anchors in case of grounding.

In shackling the chain cables to the anchor, and one length to another, care must be taken to have the pin of the shackle aft, otherwise the shoulder of the pin-flange may catch and break the

FIG. 14.



ANCHORS.

- | | |
|---------------------|-----------------------------|
| A. Ordinary anchor. | C. Patent stockless anchor. |
| B. Patent anchor. | D. Patent anchor. |
| E. Kedge anchor. | |

PARTS OF ANCHOR.

- | | |
|-----------|-------------------|
| 1. Trend. | 5. Fluke or palm. |
| 2. Shank. | 6. Pea or bill. |
| 3. Crown. | 7. Stock. |
| 4. Arm. | 8. Shackle. |

shackle when the anchor is let go, and the chain running out rapidly.

The pins of the shackle are fitted with small holes in one end, to correspond with holes in the shackle flange. This arrangement allows the driving of a wooden plug through shackle flange and

pin in a way which prevents its coming out, and yet allows of its being easily broken, when it is necessary to slip the cable.

The shackle securing the chain to the anchor should be fitted with a split ring, a forelock, and a wire seizing.

There are various methods of securing an anchor. The stockless anchors simply heave right up in the hawsepipe (the crown flange pieces form a convenient stopper to the pipe).

In anchors with stocks, a shackle attached to the shank balances the anchor. A crane or davit is fitted on the forecastle head. The tackle from the davit and crane is hooked on to the shackle, and the anchor hove right up on the bill-board, which is the piece in the bows to which the anchor is secured, with the cat stopper rove through the ring, and shank painter round the shank and one arm. From this place also the anchor is let go.

There is a special apparatus used for letting go the anchor from the bill-board. When there is a high drift from the sea, and the anchor is heavy, it is advisable to let it go from the hawse-pipe, first lowering it to that point with the tackle, and heaving in the slack chain. Stockless anchors are always ready to let go.

In getting the anchor on board, care must be taken to prevent its knocking about, and making a hole through the bows.

The officer in charge of the anchoring should keep the captain informed of the position of chain and anchor when let go, and in heaving up.

It is well to call out the fathoms and general trend of the chain, so that the master may place the ship in the best way to assist in getting the anchor away, or in getting the required chain out.

When heaving in, notice should be given directly the chain is up and down (that is, when it is over the anchor); when it is away; and when it is sighted.

A touch of the engines in a steamer will often simplify the breaking out of an anchor from the ground.

Should the anchor come up foul (that is, with the bight of the chain caught under or round the fluke or stock), or should there be any other complication, it must be cleared before being got on board.

The shackles should be examined as they come in, in case they may be damaged.

Turns of seizing wire are placed round the studs in the chain to mark off the length. One turn of seizing wire on the stud, one link abaft, marks 15 fathoms; two turns of seizing wire, two links abaft, marks 30 fathoms; and so on, so that it is easy to see the amount of chain out.

From time to time all chains in a ship should be thoroughly overhauled, blacked, resecured, and all pins knocked out and re-

placed. A good moment for such work is when a ship is in dry dock. Anchors should always be buoyed. Buoys may be made for the purpose out of paint or oil drums, or pieces of wood to which a line rather longer than the depth of water anchored in is bent.

Its end is clove-hitched over the crown of the anchor. A length of chain on the part attached to the anchor is a useful precaution, as in the event of the cable breaking, or the anchor getting jambed, it could be lifted with this chain.

ANCHORING A STEAMER.

Before coming up to an anchorage, the officer in charge of the work should see that the chain and anchor are quite clear. The captain judges when it is best to let go, and he gives the necessary order.

It is not well to stop the ship, or the chain may settle down on the top of the anchor, and perhaps trip it out of the ground when the ship swings round. It is better to have, if possible, a little stern way on when letting go the anchor, as this will help the chain run out well ahead. When the right amount of chain is out, the way can be stopped.

The state of the weather, and the condition and depth of water at the anchorage, determine the length of chain to be let out.

ANCHORING IN A SAILING SHIP.

In coming to an anchor with the wind off the shore, clew up and snug up sail on approaching the anchorage, leaving only the upper tops'ls, jib, and stays'ls, driver, or spanker. Then, when just at the anchoring-place, shoot the ship up into the wind, and let go as soon as she loses her headway. Take the sail in at the same time.

If coming to an anchorage with the wind aft, choose which way the ship is to be turned, paying due regard to the vicinity of other vessels.

The second anchor must in all cases be ready to let go, and attention should always be directed to the prevailing gales.

MOORING.

Just before reaching the spot, let go one anchor, and keep enough way on the ship to stand over the place, paying out chain all the time; then (having overshot the mark sufficiently, and brought the ship up), let go the other anchor, and give her stern way. Pay out at the same time the chain last let go, and heave in on the other until the right position is obtained.

In **unmooring** pick up one anchor first; slack away in the other chain, so as to get over the anchor, and when it is up, proceed to pick up the other. Judgment must be used as to which anchor it will be best to pick up first.

If a ship is to be moored in a harbour or river for long, a **mooring shackle** (which is a large swivel with four links attached) should be used.

The cables are unshackled and then shackled to the four links. The movement of the swivel prevents turns in the cables.

While the chain is being unshackled for the purpose of placing the swivel, its anchor side should be held by a chain or wire-stopper. The swivel should be put on cup uppermost, so that it may be easily lubricated, and a mark should be put on the cables to distinguish them from one another when the swivel has to be taken off.

LAYING OUT AN ANCHOR.

It is often necessary to lay out an anchor, either to warp the ship round, to act as a spring, or to heave her off a bank. For this purpose, a kedge, or stream anchor, is taken out in a boat, with the necessary stream chain, or hawser, and let go.

The end of the chain, or warp, is then taken on board and hove in on. A square-sterned cutter is the best boat in which to take out the anchor from the ship. There are three methods of carrying out a small anchor.

First method: Take three capstan bars and fix them over the stern, as in Fig. 15, which shows:

1. Capstan bar laid athwart boat's gunwale.
2. Capstan bars laid end over the stern, and on top of capstan bar 1.
3. The anchor to be taken out.
4. Stream chain or wire hawser coiled in boat on the thwarts.

The anchor is stopped to the boat, and when required to be let go, the anchor stops are cut, the capstan bar (1) is raised, and the anchor slid over the stern, care being first taken that sufficient chain or hawser is paid overboard to enable the anchor to reach the bottom, without jerking the hawser or chain out of the boat. Chain can then be paid out gradually, the stops being kept on the bights to keep it from running out too fast.

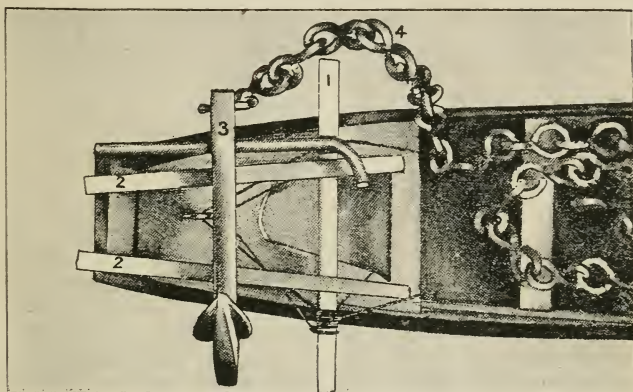
In the second method,* the boat may be fitted with a movable davit in the stern-sheets, and the anchor laid in the stern-sheets, with stock up and down over the stern, and one of the flukes rest-

* I am indebted to Captain P. Thompson, F.R.A.S., Board of Trade Examiner, for this handy method.

ing on the gunwale, the other in the bottom of the boat ; from this position it can easily be tipped over the side by lifting upon the fluke that lies in the bottom of the boat.

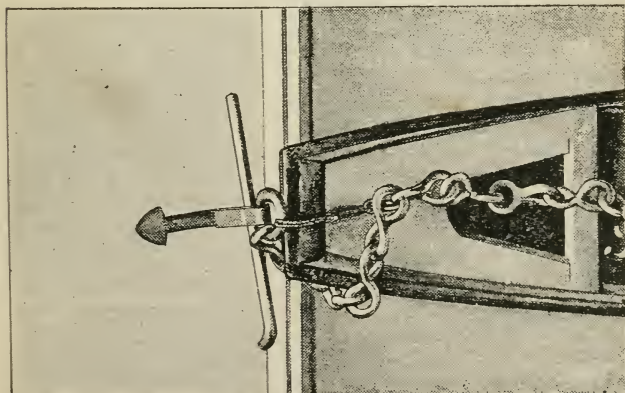
In the third method the anchors can be hung over the stern amidships, by a stop to the ring, and let go when required (Fig. 16).

FIG. 15.



LAYING OUT AN ANCHOR.

FIG. 16.



LAYING OUT AN ANCHOR (ANOTHER METHOD).

In all cases it is well to take the precaution of paying over a sufficient amount of chain or hawser to reach the bottom.

The boat can be steered by an oar : buoys should always be fitted to the anchors.

SENDING YARDS UP AND DOWN.

T'gallant and royal yards are sent up and down by a single gantling. This operation had formerly to be constantly performed at sea. It is not often necessary nowadays, except in port, when it may be desirable to get rid of as much top hamper as possible if the vessel is light.

Reeve a rope (the size of which will depend, of course, upon the weight of yard) through the masthead sheave, or through a block lashed there; bring the end down on deck, on the weather side (if at sea) clear of yards and gear, and bend it on to the halliard shackle of the yard. Stop the gantline out on the yard-arm side you wish to go up first, about 18 inches or 2 feet from the shackle, for the quarter stop; and at the yard-arm, for the yard stop.

This will ensure the yard going up straight. See that the lifts for shackling on to the masthead and other gear are clear; put a tripping line on to the lower yard-arm, to steady it up, and hoist away. As soon as it is well up on the mast, by the cross-trees, put the braces and lifts on, and take off the yard-arm stop, shackle in the lifts to the mast-head, lower the yard, ease up the quarter stop and secure the parrel as the yard lowers into its place.

Cast off the gantlines, shackle on the halliards, pass and secure the foot ropes, and see that the halliards are quite clear of stops, and that the braces and lifts are in order. The tripping line can generally be dispensed with in harbour. In some cases the lifts are fitted to the mast-head with lashings, and in other cases the topgallant lifts are led through a thimble, and down to the cross-trees. Heavy topgallant yards are fitted with a chain tie, a wire runner, and a tackle.

Topsail Yards are sent up with a tackle or stout gantline, which should be secured just outside the tie band of the yard. Another single gantline (topping rope) should be rove through a block, on the head of the topmast, and made fast to the yard-arm, on the side to which the yard tackle or rope is made fast.

When hoisting commences the topping rope serves to cant the yard up on end (it really takes the place of a yard-arm stop); a tripping line may or may not be necessary; circumstances must decide that.

Put lift and brace on the upper yard-arm when it reaches the

top and heave away. As soon as it is clear of the topmast-stay, shackle, or secure the lift, and get the lower yard-arm lift and brace put on. Heave away, slacking on the topping-lift so that the yard can square somewhat; get the lower lift fast, slack down the yard tackle, or rope, and secure the parrel and topsail tye (if an upper yard); or fix on to the crane (if a lower yard). Upper topsail yards are fitted on the tye band with an iron block, through which a chain is rove. The standing part of this chain is fixed on to the foremost topmast trestle-trees, and the other end rove through the sheave at the topmast-head under the cross-trees. There is a block shackled to this end, through which is a runner with three-fold tackle attached. Sometimes the tye is single, in which case the runner abaft is generally double.

PART IV—(continued).

B.—SAILMAKING.

It is unlikely that a young officer will be called upon to cut out and make new sails; but it is important that he should thoroughly understand the principles of sailmaking, as much of the repairing and mending required may come under his direction on a sailing ship, and possibly also on a steamer.

It is customary to carry two suits of sails. A third set of lower topsails is also frequently carried.

The best sails are bent where the worst weather and strongest winds are encountered. The second suit is used in the tropics, and trade-wind regions.

The tools employed in sail-making are :

1. **Palm**, which is worn on the hand, and used for forcing the needle through the canvas.
2. **Creasing stick**, a piece of hard wood or steel, split at the end, used for creasing seams.
3. **Needles**, which are three-cornered, and which should not have the edges too sharp, or they will cut the canvas threads, when pushed through.
4. **Fids** of different sizes, for making eyelet holes and stretching cringles.
5. **Anvil**, for knocking in patent thimbles.
6. **Grease horn**, to hold grease, into which the needle used in sewing is dipped now and then.
7. **Rubber**, for rubbing down seams, a piece of steel set in a wooden handle.
8. **Pricker**, a kind of fine marline-spike, set in a wooden handle, for piercing holes in the canvas.
9. **Sail hook**, for holding the canvas while stitching.
10. **Blue pencil**, for marking, &c.
11. **Knife**, preferably a shoemaker's knife.

Canvas or **sailcloth** is made of long flax and is put up in rolls or *bolts*, as they are called. The canvas in each bolt has an average length of forty yards, and a width of twenty-four inches.

The threads running lengthways are called the *warp*, and those across, the *weft*. The edges are called *selvages*.

In cutting canvas—except for gores or other special purposes—care should be taken to cut with the thread. When canvas is cut at an angle, it is called a *gore*. This gore must be carefully cut if the sailmaker would avoid a baggy sail.

Canvas varies in stoutness, and runs from 1 to 8. No. 1 is the stoutest and No. 8 the lightest, but No. 6 is the lightest in general use.

Tarpaulin canvas is a coarser and commoner canvas for making hatch-covers and such like.

If a pricker be thrust through good canvas the threads break with difficulty. In selecting canvas the best quality should be chosen.

Boat-sails are generally made of duck, which is usually split up the centre.

Twine made of flax is used in joining canvas to make sails. There are two kinds of flax twine. The ordinary one is made up of three strands running about 400 fathoms to the pound. A heavier make, called *roping twine*, is used for attaching the roping to the sails.

Before use, all twine should be dipped in Stockholm tar, softened with oil, and wrung out. One end of the skein may be cut, so that the threads can be drawn out as wanted, or the whole skein may be balled and cut as required.

As has been explained, a gore is a diagonal cut across the canvas. All sails are gored unless they are absolutely square. All square sails, except the fore course,* are gored on the leeches, and on the foot forming the roach of the sails. The fore course is gored only on the foot. Jibs† are gored on the luff and foot. Great care must be taken in cutting the gores to prevent the sail getting any belly. This precaution is particularly important in fore-and-aft sails.

Tabling is the part of the sail turned in, to which the roping is attached; it is a sort of wide selvage which may vary from six inches in courses to three inches in light sails.

Lining cloths are extra pieces of canvas sewn on to a sail in the way of any chafing (for instance, to the sail on the after part where it is likely to flap against the mast), or in the way of bunt-

* In some modern sailing ships there are one or two cloths gored on account of the long bow.

† Except cross cut jibs shown in Fig. 7a.

lines and spilling lines, &c. Lining cloths are also used to assist in distributing the strains on a sail, at the clews or at other situations, where they may be subject to violent jerks.

There are three seams generally used in joining canvas. The **round**, the **flat**, and the **round seam** not rubbed down. The **round seam** is the strongest, but it appears to be going out of use, as the flat seam is made more easily, and is less liable to chafe.

To join two pieces of canvas to make a sail, measure and cut the length required. Mark the width of seam on one piece, and **round seam*** the other to it. Place the hook in the canvas to the right hand, and work towards it (Fig. 17). In working, thrust the needle perpendicularly through the parts. A beginner

FIG. 17.



ROUND SEAM.

should pay attention to the correctness of his attitude and method of sewing, not only because of the greater facility to himself, but because work done in the right way is sure to be well done.

When the round seam is made it should be rubbed down with

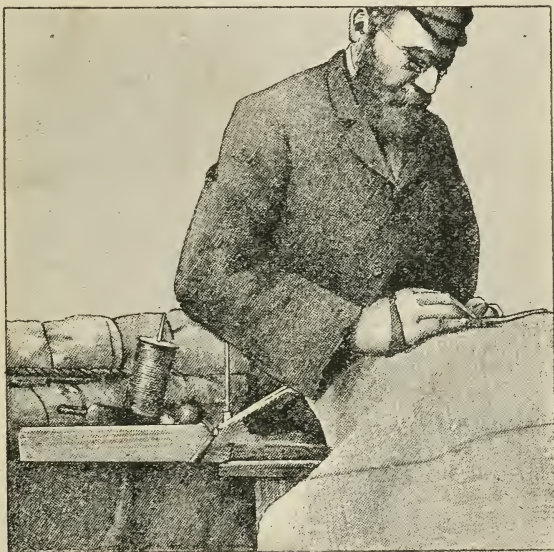
* Seams should be $1\frac{1}{2}$ inch wide for heavy sails and $1\frac{1}{4}$ inch wide for light sails.

the rubber. Work from the hook and take care to get the seam quite flat.

Now put in the flat seam (Fig. 18), stitch this time from the hook, and keep the fore-arm in a line with the seam.

When sails begin to show signs of wear they should be middle-stitched, that is to say, a plain in-and-out stitch should be run down them parallel to the old seams, and nearer one or other seam than to the centre between them.

FIG. 18.



FLAT SEAM.

Sails should be overhauled before they are placed below, and before bending. Pieces of paper should be liberally strewn about the sail room if there are rats in a ship, otherwise they will gnaw the sails.

To repair a small rent in a sail, draw the edges together with a herring-bone stitch, and cover the mended rent with a patch of tar.

Roping.—The rope that goes round a sail is known as bolt rope, and is 3-stranded, yarn-tarred, Russian hemp.

Latterly wire has come much into use, and is fast superseding hemp. Great care has to be taken in attaching hemp rope to the sails, as it stretches a good deal, and can only be properly sewn on to a sail by a thoroughly experienced hand. The rope is sewn to the canvas, not the canvas to the rope, and allowance of slack canvas has to be made. Practice only can determine the amount of slack that should be allowed.

Wire rope should be served all over (not wormed or parcelled), and is spliced direct into clew and earing irons.

Cringles are worked into the leeches and feet of sails, and thimbles are put into them in which to bend the buntlines, &c.

Cringles are made of strands of the same rope as is sewn on to the sail; they are worked right round the bolt-rope.

PART IV—(*continued*).

C.—THE SAILS, ETC.

Bending and Unbending Sails—Making up Sails—Setting Sail—Taking in Sail—Trimming Sail—Tacking, Wearing, and Heaving to—Steering Gear—Sheers—Fitting Topmasts, Topgallant and Royal Masts.

BENDING AND UNBENDING SAILS.

THE aim in bending sails is to get them into position as quickly as possible.

To attain this end the sail should be made up on deck, the roping down (as it would be when on the yard furled). The earings should be left out. The clew spectacles are left out at the yard-arms or amidships, according as the sail is clewed up at yard-arm or amidships.

The bull's-eyes and the foot of the sail should be easy of access for reeving or bending on the buntlines, leechlines, or spilling lines.

The stops on the sail should be regulated in accordance with the weather. When it is calm no stops are necessary; but when rough, and the ship is rolling about, the sail must be well stopped up. A tail snatch-block bent on to the sail-rope, and the gantline snatched in it, will steady the sail as it goes up. The earings may be hitched to the sail rope, which should be a single line rove through a block at the mast-head, and brought down, so that the sail will go up as clear as possible. In calms, or with the wind well aft, this will be before the yards; but with the yards braced sharp up, it will be abaft, and on the weather side. If the winch is available, the line is led to it, and the sail quickly whipped up.

A hand or two should be stationed aloft to see it go up clear, except on a lower topsail—which should be bent with spunyarn—the sail should be made fast to the jackstay with rovings of good Europe rope-yarns.

The sail rope should be bent on around the sail, so that the midships head-stop is clear.

In bending a course, the usual plan is to overhaul the buntlines down, and to reeve them in the sail on deck, stopping the head of the sail to the buntlines and bending on the clew garnets and reef tackles (if used).

It is not necessary to go into details for each sail, as the general principles laid down can be modified by an officer according to circumstances.

Earrings should be passed as follows: Take the end round the lift bolt on top of the yard-arm, pass it up through the earing cringle (this gives a good purchase to haul out the earing), then pass the end down abaft the yard, and bring it up through the head earing cringle on the fore part of the yard, pass the required turns, securing the ends when expended or when enough turns have been taken. This will keep it well up on the yard.

BENDING A JIB.

Bending a Jib.—See the hanks all clear on the stay. Stretch the sail out and make it up on the foot, stopping it here and there.

Bend the halliards, and downhaul on to the part just abaft the luff, haul on the downhaul and tend the halliards. A line should be made fast to the clew to steady it out with. As soon as it is out to the stay, secure the hanks (which are on the stay) to the sail, reeve the tack, bend on the downhaul and halliards properly, and shackle on the sheet pendant.

In unbending reverse the process.

A staysail can generally be easily carried to and bent on the stay.

A SPANKER OR DRIVER.

A Spanker or Driver.—If the gaff will not lower down, the brails are overhauled and made fast at the bights to the after-part of the sail, which is then hoisted into place. The tack is secured by a line hauled well tight.

A driver is fitted with a tripping line.

SETTING SAIL.

In setting, as in taking in sail, the object aimed at is the prevention of the sails beating about more than is absolutely necessary; otherwise there may be much chafe and wear.

Topsails are generally the first to be set. Point the yards to

what will be their approximate trim when the sail is set; loose, the sail and sheet home, lee sheet first, then weather sheet. The hands aloft should well overhaul the gear.

In hoisting yards the lee-brace should be let go, and the weather-brace tended, while the yard is going up (when the wind is well aft *both* braces must be tended or the yard will fly about). Sheets leading to sails above must be let go, also downhauls. Overhaul and stop the gear.

To keep the lifts of the upper yards from chafing the sail when set, place them abaft the yards.

In setting a single topgallant sail or a royal, point the yard to the wind. Loosen the sail lee side first, overhaul the gear and sheet home to windward, then to leeward; let go the lee-brace, hoist the yard and trim.

In setting a jib or staysail, see the downhaul all clear for running, halliards in lead blocks for hoisting. Loosen the sail, let go the downhaul, steady the sheet aft, and hoist away smartly. Have another pull of the sheet, if necessary.

Setting a Driver or Spanker.—Overhaul the brails, haul aft the sheet to steady the sail, then the outhaul, set the sail properly with a final pull of the sheet, and slack the weather vang.

Setting a Course.—If the yard is braced up at all, see the weather lift hauled well tight (the lee lift will be well overhauled if the yard is sharp up to avoid chafe against the lee rigging). Loosen the sail, overhaul the lee gear, and haul aft the slack of the sheet to steady the sail. Then board the tack, haul aft the sheet to set the sail properly, reeve and haul out the bowline.

TAKING IN SAIL.

In taking in either a **single topgallant sail** or a **royal**, lower the yard, round in on the weather brace, starting the lee sheet at the same time. Haul in smartly on the weather-brace, and point the yard to the wind so as to spill the sail. Haul up on the lee buntlines and leechlines (if fitted) and clewlines, then haul up to windward, steady tight the lee brace, halliards, and sheets, lay aloft and furl, commencing on the weather side if single handed, as this will spill the sail still more, then trim the yard to the wind as if the sail were set.

In taking in a lower topsail, haul up first the weather clew, manning the buntlines or the spilling lines at the same time, to keep the sail steady, then haul up the lee clew.

In hauling up a course, haul tight the lifts and proceed as in a lower topsail. Slack off a fathom or two of the lee sheet as the

gear is hauled up. When the weather gear is as high as possible, man the lee gear, haul, snug up, and furl.

In furling square sails* the leech should be picked up along the yard and then the sail skinned up by reaching over the yard and picking up to the last fold. All should then be tossed well up on the top of the yard, the last skin forming a kind of cover which prevents rain getting into the folds; the gaskets should be passed from before aft up round the fore-part of the sail and yard. This tends still further to haul up the sail on the yard. The bulk of the sail will be in the bunt. It is very convenient to have a single whip fitted under the top in the courses, to hook on to a grommet fitted in the sail; this whip can then be used to assist in getting the bunt well up.

Taking in a Jib or Staysail.—Man the downhaul and let go halliards, hauling down smartly on the downhaul, until the sheet holds the sail, then slack off sheet carefully, and haul down. A wipe off with the helm, for a point or two, will materially assist in getting one of the head sails down, and it will also save a good deal of unnecessary flapping of the sails.

A judicious touch of the helm can often assist very materially in shortening sail, without appreciably altering the course of the ship.

Taking in a Driver or Spanker.—Man the lee brails and the downhaul, if fitted; slack away the sheet, and haul on the brails (lee brails best), and downhaul. If the weather brails were hauled on, the sail would be kept full of wind, which would prevent its coming in snugly; but by the hauling on of the lee brails, the sail is spilled and so comes in very easily.

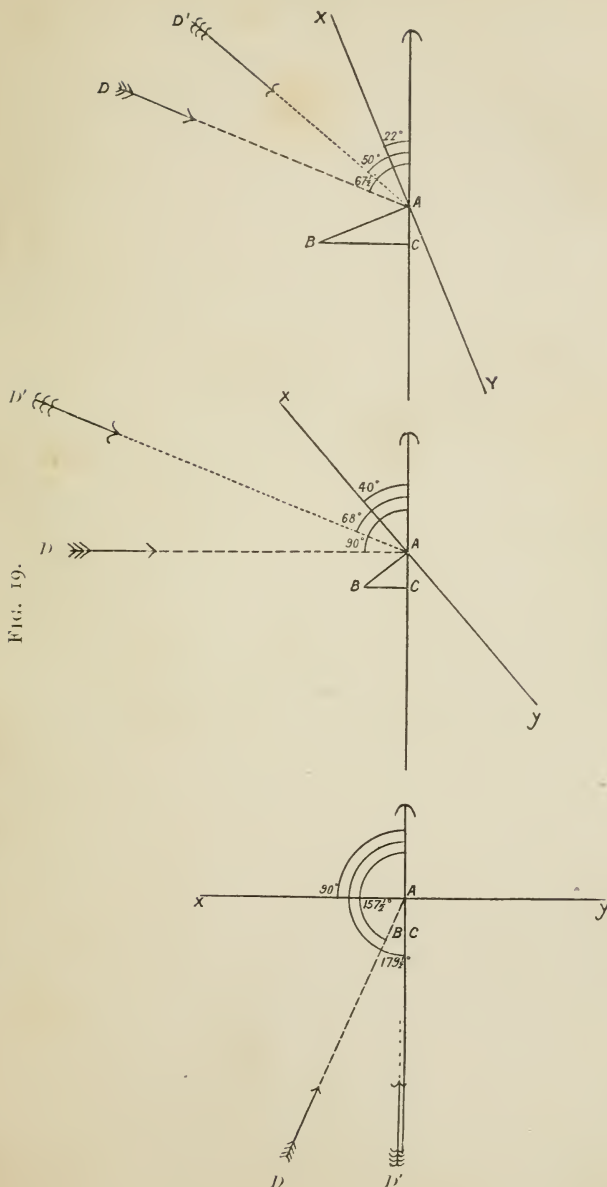
A **tripping line** is often fitted to lower staysails to lift the clew over the stays, when the staysails are used in tacking ship. There is not much real advantage to be gained by carrying on staysails (except the fore staysail), with the yards braced sharp up.

TRIMMING SAIL.

The young officer should pay careful attention to the trimming of sails and yards, as that is a matter which may very materially affect the length of a ship's passage. A check in of the yard here, a foot or two of sheet there, is likely to add a knot an hour to the speed. The principle on which sails act may be explained briefly thus:

If pressure be exerted on any surface its result is a tendency to move it in the direction in which the force acts. The pressure may be resolved into forces, one of which acts at right angles to the surface. This force may be further resolved (in the case of a

* That clew up to the bunt.



TRIMMING SAIL.

True direction of wind. \longrightarrow
 Apparent direction of wind. \longrightarrow
 Yard or sail. \longrightarrow
 Direction in which vessel is moving. \longrightarrow
 The Wind. D

In triangle ACD .
 AC = Force tending to send the ship ahead.
 CB = " " " " sideways.
 AB = Useful effect of wind.

sail surface) into two forces, a fore-and-aft force and an athwart-ship force.

For instance, in Fig 19 D is the wind and XY the sail; the ultimate force of the wind will be represented by the line BA at right angles to the surface of the sail XY. (To simplify matters the sail is supposed to be quite flat.)

This force may be resolved by the triangle of forces* into forces CA, tending to propel the ship ahead in the fore and aft line, and BC tending to produce leeway.

In Fig. 19 the letters D, D' show the true and apparent direction of the wind. We say "the true and apparent" because the motion of the ship through the water may draw the wind further ahead or astern, and so alter its direction and velocity in regard to the course of the ship.

Three different directions of the wind are illustrated. The figures noted in the triangles are drawn to the scale of the speed of the wind and are intended for comparative purposes only.

As the side of a vessel offers much greater resistance to the water than the bow, the force, which tends to send her forward is much more effective than that which inclines her sideways, though the latter may be the stronger of the two.

This is why the ship forges ahead, tending but slightly to leeward. The force sending the ship to leeward is greatest when she is braced sharp up; it diminishes to nothing when the wind is well on the quarter. The illustrations show clearly the alteration effected in the pressures by change in the direction of the wind.

It is difficult to determine exactly the difference in the resistances; but the angle between the ship's track and her fore-and-aft line (course) will give the amount of leeway.

Consideration of these matters show clearly how necessary it is that the sails when braced sharp up should be set as flat as possible.

There are other questions to be decided, as, for instance, whether, when staysails are carried, there should be much or little after canvas.

The after square sails (if such are being used on a ship) may, in many cases, be reduced with advantage, and the staysails (with the exception of the foretopmast staysail) may be taken in, as they have a tendency to sag a vessel off to leeward, as also to send a side draught against the square sails which may be injurious to their proper action.

The upper yards do not require such sharp bracing up as the

* See Mackenzie's "Practical Mechanics," p. 103, Griffin's *Nautical Series*.

lower yards, on account of their lesser depth of sail; which fact also gives the double topsails and t'gallant sails a great advantage over the old-fashioned deeper sails, which, in a breeze, are often set flat with difficulty.

It is necessary to slack rope gear all round in wet weather; when it is fine again, all should be hauled taut and the sails properly reset.

BRACING UP AND SQUARING IN.

In light winds each yard should be slightly inside the yard below; but as the wind grows stronger the difference should be increased by checking in the upper yards.

It is always advisable not to brace the yards sharp up unless it is absolutely necessary to do so, as on many occasions a point off her course will make little difference in the ultimate course made, but will make a great difference in the speed.

In **bracing up**, operations should be commenced on the foremast, because if this is not done, there is a tendency to bring the ship up into the wind, owing to the increased force of the wind on the after sails. In **squaring in**, operations should be commenced on the mizen or aftermost mast, because the sails there feel the effect best, and make it easier to trim the forward yards; it also prevents being caught by the lee.

In bracing up, the lee lower lifts should be let go, the weather ones hauled well taut, and pulls got of the tacks and sheets of the courses, and sheets of the fore-and-aft sail when the yards are trimmed. Care will be necessary in slacking away the weather-braces, particularly if the wind be strong. The officer of the watch should see to this himself, and, if not actually slacking away, should see that a careful hand does it.

In squaring in, the lee-braces should be let go, and hauled taut again when the yards are sufficiently in.

TACKING AND WEARING, ETC.

A square-rigged vessel, at her best, can only sail within 6 points of the wind. Should the wind be blowing from the point towards which she wishes to go, it will be necessary to find means of getting her there. To effect this end, **tacking** and **wearing** are resorted to. The actual proximity of the wind's direction to the desired point, will generally determine whether **tacks** shall be long and short, or of equal length.

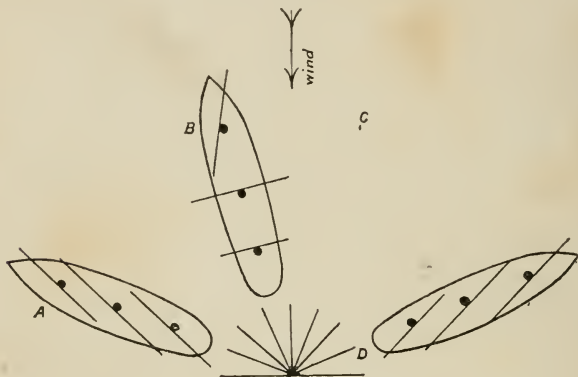
In ordinary weather, with all plain sail set (plain sail is all square sail with driver or spanker and head sails) **tacking** is

resorted to, as it is much more expeditious than **wearing**; but in bad weather **wearing** has to be adopted, as in the latter operation, the strain on the masts, sails, and yards is less. All hands are, as a rule, required for tacking; the men are stationed at different parts of the ship.

In a crew of, say, 40 men (the number likely to be carried by the vessel represented in Plate II.) they would be distributed much as follows:—

Master on poop or bridge, directing; boatswain and three hands on forecastle, to work head sails, fore tack, &c., these would

FIG. 20.



TACKING.

- A. Clean full for stays.
- B. Swinging after yards, wind being a little on the star side helps to swing them.
- C. Get head sheets over
- D. On new tack.

also tend the main-braces; chief officer and 3rd officer tend the lee main-braces; starboard watch on weather main-braces; second officer and sailmaker tend lee cross jack-braces; port watch on weather cross jack-braces; cook will tend fore sheet; the carpenter, engineer, steward and others are generally told off as belonging to a certain watch and work with that watch, after their special duties have been attended to.

Of course, any arrangement of hands can be made for working the ship, always keeping in mind that the operation should be performed as expeditiously as possible, and that as little time as possible should be lost in getting all sail set again.

Having called "All Hands" and taken in spanker or driver, and hauled up the after canvas with the watch on deck, hauled taut lee lower lifts, and having let go weather ones; see all braces clear for running, keep her clear full for stays, so as to have goodway on the ship; give the order "Ready, a'ready" as a caution; then (Fig. 20 A.), every one being at his station, put the helm down and give the order "Hard a lee;" ease off and let go fore-sheet and head-sheets; and the ship will come rapidly up into the wind. As soon as the wind is within about a point, or point and a half, of the bow, B, give the order "Main topsail haul," when the after-yards will fly round of themselves, and can be braced up sharp on the new tack. The head-sheets are then hauled over the stays, and hauled aft ready for the new tack. This should not be done until the wind is on the other bow, C. As soon as the wind is about 6 points on the other bow, D, give the order "Forebowline let go overhaul," when the head-yards will be swung round and braced up on the new tack. Tacks and sheets are hauled down, and aft and spanker or driver set. If this manœuvre is properly done, it should not take longer than ten minutes.

When it is necessary to tack very often, it is a good plan to belay the braces to a certain mark, hauling them in on the bight.

It sometimes happens that a vessel **misses stays**, that is, after the after-yards are swung, refuses to come round; nothing can then be done but let her come round on her heel, shift the helm and let her pay off directly it is seen that the way is stopped; as it is dangerous to allow her to get stern way, flatten in the head sheets. After the helm is shifted, square the after-yards, keeping the sails shivering, until she goes well off. As she pays well off, and the wind comes on the other quarter, brace the after-yards sharp up, then the head-yards, and bring her, too, on the other tack.

WEARING.

In bad weather, or if the sea is heavy, it will generally be necessary to wear round instead of tacking. In this manœuvre the vessel goes off the wind and comes to on the other tack.

Haul up the after courses, as before, and take in the driver and spanker. Put the helm hard up, square away the after-yards, keeping them just on the touch; this will enable the wind to exert its full force on the foresail so as to turn her quickly. When the wind is aft, run the fore-yard square, and haul the head-sheets over.

Then brace up the after-yards (which will have the effect of bringing the ship up on the new tack). Watch carefully that she

does not come up too quickly ; brace up the head-yards, and see all clear. In wearing ship with a heavy sea on, constant watchfulness is required to save her from the damage which may be done through a sea coming on board.

HEAVING TO.

For the purpose of picking up a man who has fallen overboard, or to take the pilot on board, or for any purpose for which the ship must be stopped, the sails should be disposed so as to stop all way, and yet, at the same time, maintain a more or less fixed position. To obtain this with wind on the quarter, put the helm down and brace up the after-yards, leaving the fore-yards square, meeting her with the helm as she comes up to the wind, and shortening sail if necessary. With the wind on the beam, or thereabouts, put the helm down, and lay the after-yards square, meeting her with the helm, as before.

STEERING GEAR.

The apparatus that controls the direction in which the ship is going is the steering apparatus.

It consists of the two primary parts—the **rudder** and **tiller**.

A rudder consists of a frame and plating ; the upper part forms the rudder head, into which the tiller ships ; the lower part is widened out, and the whole is attached to gudgeons on the stern-post, or rudder-post, by means of pintles on the rudder shipping into or on to them.

The rudder head passes up through the rudder trunk. The latter has a stuffing-box, which serves to keep the rudder steady, and prevents water coming up into the vessel. The head is brought up through the upper deck, and on to it is attached the arrangement of tiller, quadrant, or arms, whereby to turn the rudder with the wheel.

In the old days, the vessels, being small, were steered by means of a spar fitted into the rudder head, pointing forward, and called the helm, or tiller ; from this position of the helm rose the steering terms of **port** or **starboard** the helm, rules which are still in vogue, although, in the generality of cases, the tiller is now shipped into the after side of the rudder head. The necessary purchase for moving the rudder is obtained by means of tackles, the ends of which pass round the barrel of a wheel. It is now usual to fit the rudder head with quadrants, to which chains are attached, and in steamers, the rudder-chains are worked by a steam-engine.

But in all cases the principle is the same ; and wherever the

tiller, or other appliance, may be fitted, when the order "Port the helm!" is given, it means that the ship's course is to be altered to starboard by placing the rudder over to starboard, and *vice versâ*.

The wheel is an apparatus with the principles of the lever applied,* which enables one man to overcome the effect of resistance. As a general rule, the wheel, the rudder, and the ship's head move in the same direction. Some attempts have been made lately to alter this arrangement, but without success, as there seems to be no very great reason why the old order should be altered.

The effect of the water on the rudder, when it is turned from the fore and aft line in any direction, is to throw the vessel over, away from the pressure of water, the centre of revolution of the whole vessel being somewhere about two-thirds forward from the stern.

When the rudder is first moved over, the whole vessel is thrown somewhat to leeward of its original course, and the full action of the water on the rudder is not observed, so far as turning the vessel is concerned, for a few seconds.

The aim of a helmsman should be to move the wheel as little as possible, and to check any variation from the course by small movements of the helm. Directly a helmsman begins to give much helm the steering becomes very wild, and it is only with difficulty that a steady course can be again attained. In ordinary smooth, fine weather, a modern mail steamer can be kept easily within a degree or two of her course; a cargo vessel and a sailing ship within half a point. In bad weather, the variations will be greater. In a sailing ship, when going along "full and by," it is a good plan for the helmsman to keep the weather clew of the mizen-royal just lifting, the officer on watch noting the course made good.

When the wheel is relieved, the helmsman should give the course to the relieving helmsman clearly and distinctly, and the other should repeat it, so that the officer on watch can hear.

In steamers the action of the water on rudders is somewhat affected by the holes for the propellers, and by the propellers themselves (this, of course applies chiefly to single screws).

As a general rule, supposing the blade of a propeller to be right-handed, its effect, when working, will be to throw the stern of the vessel off in the opposite direction to that in which the blades of the propellers are working.

Thus, the bow of a vessel having a right-handed propeller will tend to go to starboard, when the vessel is going ahead; and the effect will be the same when she is going astern, the helm not being

* See Mackenzie's "Practical Mechanics" in this series of volumes.

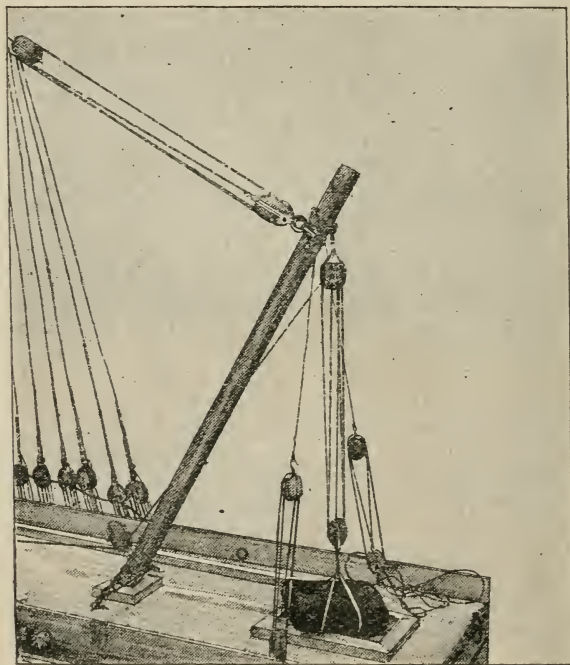
touched; and *vice versa* with a left-handed screw. But this is likely to be affected a good deal if the vessel is light, and has parts of its propeller blades out of water, or if the engines are suddenly reversed.

Too much confidence should never be placed in this theoretical action of the propeller, either in going ahead or astern, as it is liable to be much affected by wind and tide, and caution should always be exercised in manœuvring. Nothing but experience can assure a man of the powers of his vessel.

RIGGING SHEERS.

It will often be necessary to rig sheers on board a ship, either for lifting out a heavy weight, such as a boiler, a piece of machinery,

FIG. 21.

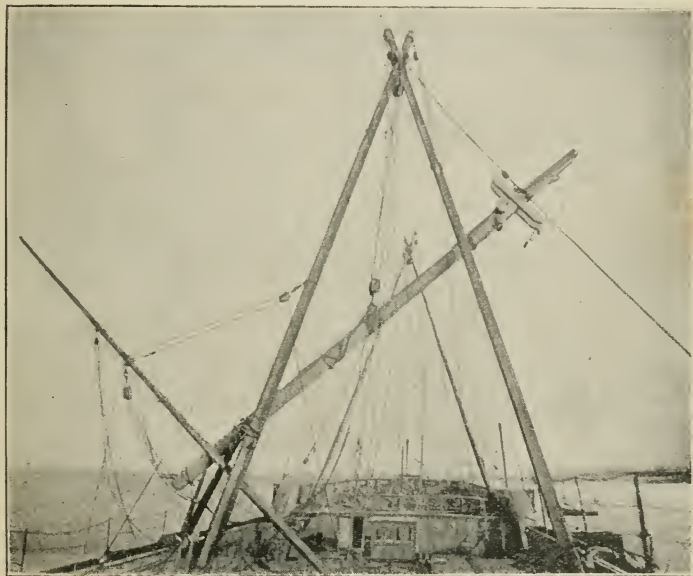


RIGGING SHEERS.

or a mast; or for lifting a weight in or out, where yards or fitted derricks are not available.

A single spar will do in some cases, and is called a derrick. All that is necessary is to get the spar on end, placing its base on a shoe so as to distribute the weight on the deck; it should be preferably placed over a beam or stanchion, and inclined slightly to plumb the thing to be lifted. It should be securely lashed, the

FIG. 22.



LIFTING OUT A MAST.

head being held in position by means of guys and tackles. The upper block of the tackle hangs from the place where the guys are fitted, Fig. 21.

Where this simple form is not available and when greater strength is required, two spars should be rigged, inclined in manner described, and so fixed that they span the object. In both cases the spars are laid on the deck together, a strong lashing is passed round the heads, and the heels are spread out; *this will tighten up the head lashing*; the heels are then secured with

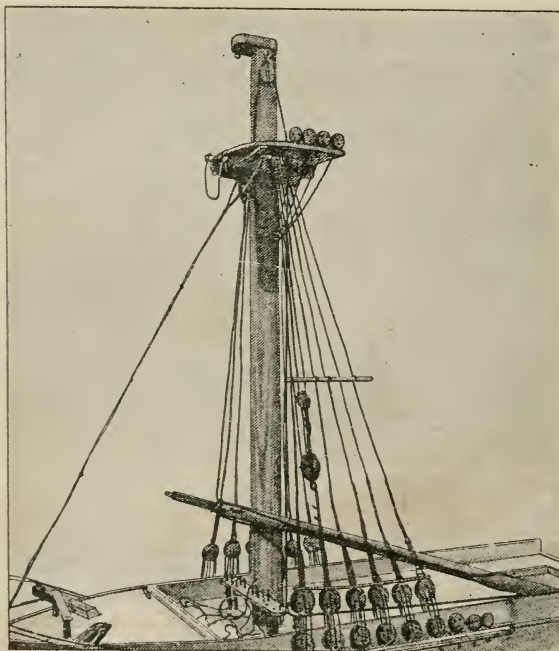
lashings, as in the other case, on shoes and the head raised either with a small pair of sheers, such as two handspikes, or by a tackle, to one of the masts.

The lifting tackle is secured over the sheer leg head-lashing and the whole is well guyed in its place. Fig. 22 represents a mast being lifted out; on the left will be seen the derrick by means of which it was put overboard.

SENDING UP A TOPMAST, T'GALLANT MAST, ETC.

Suppose a topmast is lying on the port side of the deck head forward, take a large single block aloft, and shackle it on to the

FIG. 23.



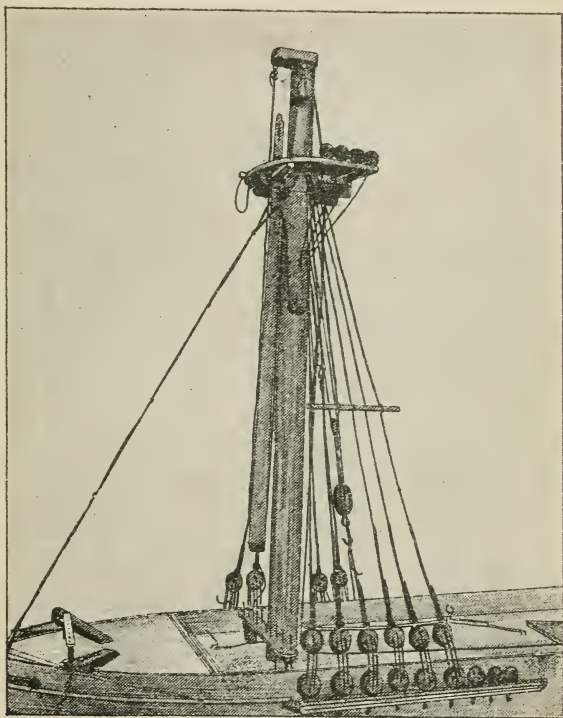
SENDING UP A TOP-MAST.

port side of the lower cap, where a ring will be found for the purpose. Through this block reeve the mast rope (the size of

which rope and block will depend upon the weight of the mast) from aft forward; bring the end down on deck through the trestle trees, and reeve it through the sheave hole in the heel of the mast.

Bring the bight down to the head of the mast, hitch the end

FIG. 24.

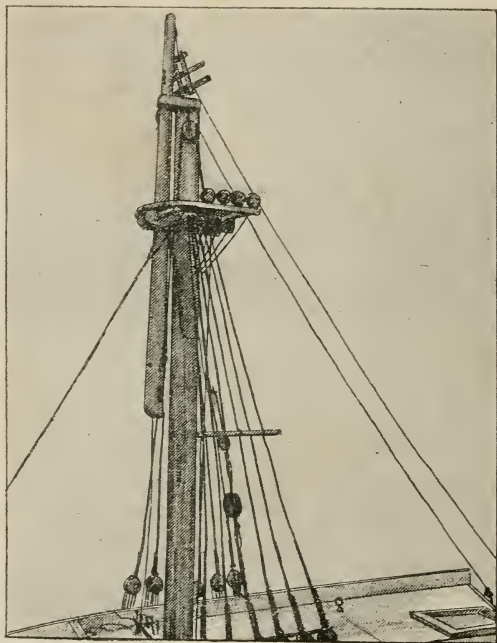


SENDING UP A TOP-MAST.

round this bight and the mast, then rack the two parts of the mast rope together between the head of the mast and the sheave, put a steadying line on the topmast (Fig. 23) and heave away on the mast rope. At sea it would be necessary to have more than one steadying line, and possibly, the lower yard would have to be untrussed, and unslung, and secured temporarily.

Heave away on the mast rope, and when the head is well pointed through the trestle-trees (Fig. 24), unhitch the end of the mast rope from the head of the mast, and make it fast on to the opposite ring in the cap, then cast off the racking and sway away. As soon as the mast-head is pointed through the lower cap, lash a gantline block to the topmast head; and reeve a gantline through it from forward aft; bend this gantline on to the topmast cross-trees, and sway them up on the lower cap, the after-

FIG. 25.



SENDING UP A TOP-MAST.

part of the cross-trees resting on the cap, and the fore-part resting against the topmast (Fig. 25). Secure it here with stops to the cap bolts, lower the topmast, and allow the cross-trees to fall over the topmast head, having first removed the gantline block when the cross-trees are secured. Well tar the mast in the way of the cross-trees, sway away on the mast, until the cross trees are in their places on the hounds of the mast.

Then lash the gantline block to after cross-tree, allowing the block to hang amidships. Tar, parcel, and place the bolsters, then send up the rigging, shrouds, backstays, stays, staysail-stays, and strops for the topsail lifts, and place all on in the order given. Hoist up and place the topmast cap; sway away the mast, and fix as soon as it is in its place. Set up the stays first, then the backstays; and, lastly, the shrouds or rigging. A **t'gallant** and **royal mast** (which are generally in one piece) are sent up in much the same way; only as they are lighter the gear can be less heavy. The rigging should be placed on the topmast cap, so that as the mast goes up through, the rigging can be properly placed by a hand on the cap. To prevent the rigging slipping down over the mast, funnels of copper are fitted on the hounds of the royal and t'gallant masts, the stay going first over the funnel, then the shrouds and backstays; and, lastly, the lift strop. The rigging should be set down on the funnel with a wooden mallet. Besides preventing the rigging cutting into the mast, the funnel holds all the rigging well together. The stays are set up first, then the backstays; and, last of all, the shrouds.

PART IV—(*continued*).

D.—HANDLING OF BOATS, ETC.

Accidents—Rocket Apparatus—Oil on Water.

HANDLING OF BOATS UNDER SAIL.

Boat Sailing is an art that deep water sailors have little opportunity of practising; and yet there is always a liability that in the event of a ship being lost at sea, the only means of getting to land will be by sailing the boats there, should any of these escape destruction. Bearing this in mind, it is well that all sailors should have experience in boat sailing, and should endeavour to improve their knowledge whenever opportunity may arise. Long stays in foreign ports at some distance from the land afford good occasion for practising, and this practice forms a most useful introduction to the art of sailing.

The handiest rig for a ship's boat is probably the dipping lug. All boats should be fitted with masts and sails, but this does not prevent any other rig being fitted to one particular boat.

For the purpose of constantly running between the ship and the shore, possibly a sprit or cutter rig will commend itself.

Barécas are the best ballast for a sailing boat, as the water in them is the same as that outside, and consequently, if an accident happens, they do not tend to sink the boat like sand ballast or pig iron. The barécas should be three-quarters filled with water, and fixed amidships by lashings.

It is most important that the trim of the boat should be carefully attended to, as upon this will depend in great measure the boat's manner of sailing, particularly when on a wind.

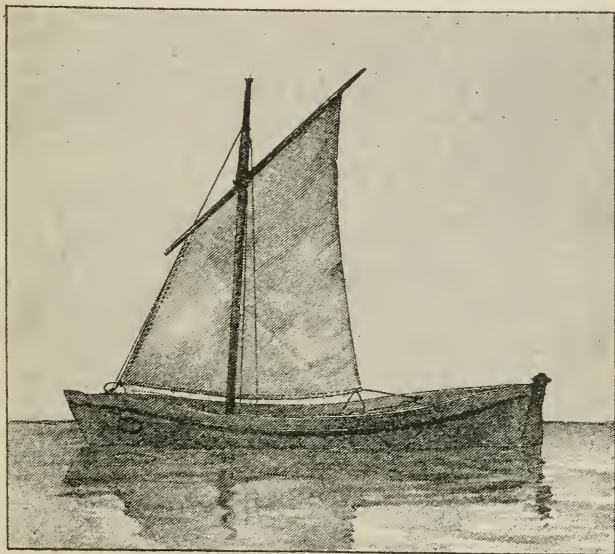
The crew should always sit down in the bottom of the boat, and nothing should be allowed over the gunwale, such as oars or rowlocks. The sheet of the sail should never be belayed on any consideration, but should be held so as to allow of its being let go on the instant, should necessity arise. It is better to unship

the mast, than to attempt to do anything to it by climbing up when shipped.

A place for baling should always be left clear.

The most dangerous position for a boat to be in is sailing with the wind and a heavy sea on the beam. In such a case it is better to sail the boat up to windward part of the way, and then to bring the wind sea on the quarter for the rest of the way.

FIG. 26.



LIFE-BOAT FITTED WITH DIPPING LUG.

Sail should be reduced directly the boat begins to wet. The tack of a dipping lug is hooked to the stem and in tacking the forward yard-arm is dipped round the mast.

When going about, the sail should be lowered just enough to dip the forward yard-arm and tack round the mast; this should be done smartly. If caught in a squall, ease the sheet; if in a hard squall, put the helm down and let fly the sheet.

Fig. 26 shows a life-boat with a dipping lug.

SEA ANCHORS FOR BOATS.

Boats are now generally fitted with small patent sea anchors, of various forms, but several oars lashed together, or the yard and sail adrift on it make fairly good sea anchors to which a boat may ride in a heavy sea. They can be attached to the painter or line.

LOWERING A BOAT AT SEA.

Before lowering a boat at sea the painter should be passed inboard, the outboard rowlocks shipped, and plugs inserted in their places; the hands should take hold of the life-lines while the boat is being lowered, and the oars should be ready for instant use.

In high-sided vessels, it is a very useful plan to have a wire guy up and down the ship's side in which is fitted a lizard; the end of this is held in the boat during lowering or hoisting, and keeps the boat from banging about if the vessel is rolling.

LANDING ON A BEACH.

Landing on a surf-bound coast is always a perilous operation, and one that requires great skill and coolness.

In some cases the breakers extend some distance from the shore and a regular gauntlet with the waves has to be run; in others, the sea breaks immediately on the beach itself.

It must be remembered that it is difficult, on account of the curling of the waves, to tell the true state of the surf from the seaward side, so that every precaution should be taken in beaching a boat.

Bear in mind that the sea breaks, because the shallowness of the water causes the top part of the waves to fall over. Herein lies the danger to a boat.

A boat going in on a wave will have the bow depressed, the velocity of the wave crest may force it under, or, if it cants the least on one side or the other, may capsize it. To avoid this, the boat should either be backed in stern first, or a drogue should be fitted, hanging to the stern, which will have the effect of keeping the boat from being driven forward too rapidly.

These precautions must be accompanied by extreme vigilance and skill in handling.

If it is merely intended to land one or two of the crew, it is well to anchor the boat, and veer her close to the beach, then the hands can jump out and the boat be hauled off immediately.

In making way out through a surf, equal skill is required; unless way can be kept on the boat, she will probably be thrown broadside on and capsized.

ACCIDENTS, ETC.

Man over-board!—The saving of a man's life in this emergency often depends entirely upon the officer on watch keeping a cool head. Put the helm down and heave the ship to, turning the hands out at the same time. Throw a life-buoy, or anything that will float, over to the man in the water; if it be dark, throw a patent light as well, and send a man aloft to keep an eye on him, or he may be easily lost sight of. Man, and send away the lee boat. The officer in charge of the operations should never go into the boat, unless relieved, as he can do more good by manœuvring the ship, so as to pick the boat up again, than he could by going in the boat.

On no account should a man be left, so long as there is any chance of his being still afloat. It must be remembered that a man can live many hours in the water.

When this accident happens on a *steamer*, go full speed astern, and stop the ship as quickly as possible.

Life-buoys should be placed about the ship in handy positions, on brackets or hooks, so as to be detachable at once.

If a man fall overboard in a heavy gale when it will be impossible to lower a boat, he may be picked up by making a smooth for him, with the ship, and oiling the water, but this is a manœuvre that can only be practised by an experienced man.

RESTORING THE APPARENTLY DROWNED.

(Extracted from Johnson Smith's *Medical Help and First Aid at Sea*.)*

“Drowning.—Death from submersion in water is caused, in most instances, by suffocation or asphyxia, all the blood in the body becoming black and poisonous, in consequence of the supply of air to the lungs being cut off. In some cases, however, death may be due to other causes: the action of the heart may be suddenly arrested by fright; the drowned person might, either before or after striking the water, have received a fatal injury from contact with some hard body; or sudden and intense shock may be produced by immersion in very cold water. The prospects of recovery, after apparent drowning, will depend on the

* This book should be in the hands of all officers.

circumstances under which the patient was rendered lifeless and insensible. If he struggled violently and for some time before complete submersion, the consequent muscular exhaustion, and, probably, more or less shock due to prolonged chilling, will have seriously reduced the force of his vital resistance to the bad effects of suffocation. If fainting or syncope occurred just as he fell into the water, the chances of restoration to life will be less unfavourable, as the lungs probably contained a good supply of air at this moment, and the entrance of water into the chest would be prevented by spasmodic closure of the upper end of the windpipe.

"The question, 'How long may a human being remain under water and yet recover?' is unsettled. In most instances of drowning—those in which a strong and healthy person finally sinks after struggling—life is quite extinct after two minutes of complete submersion. The officers of the Royal Humane Society allow a longer interval than this, and state that most generally persons are not recoverable who have been more than four or five minutes under water. There are, however, well-attested cases of recovery after ten and twelve minutes, and even half an hour (*Erichsen*), which should encourage attempts at restoration under the most uncompromising conditions.

"**Treatment.**—Send immediately for medical assistance, blankets, and dry clothing, but proceed to treat the patient *instantly* on the spot, in the open air, with the face downward, whether on shore or afloat; exposing the face, neck, and chest to the wind, except in severe weather, and removing all tight clothing from the neck and chest, especially the braces.

"The points to be aimed at are—first, and *immediately*, the RESTORATION OF BREATHING; and secondly, after breathing is restored, the PROMOTION OF WARMTH AND CIRCULATION.

"The efforts to *restore breathing* must be commenced immediately and energetically, and persevered in for one or two hours, or until a medical man has pronounced that life is extinct. Efforts to promote *warmth* and *circulation*, beyond removing the wet clothes and drying the skin, must not be made until the first appearance of natural breathing; for if circulation of the blood be induced before breathing has recommenced, the restoration to life will be endangered.

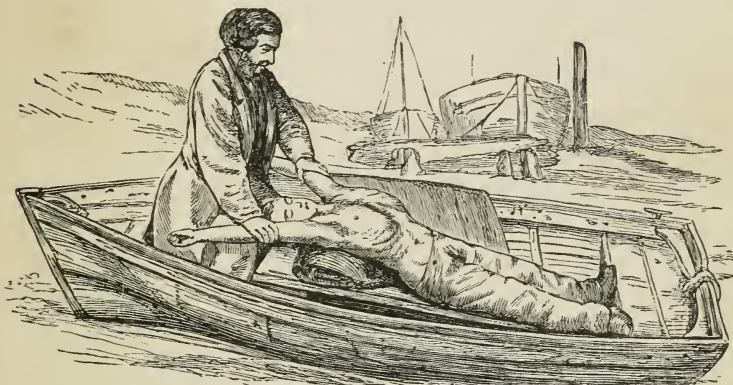
"*Dr. Syke's Method.*—Place the patient on the back on a flat surface, inclined a little upwards from the feet; raise and support the head and shoulders on a small firm cushion or folded article of dress placed under the shoulder-blades.

"Draw forward the patient's tongue, and keep it projecting beyond the lips: an elastic band over the tongue and under the

chin will answer this purpose, or a piece of string or tape may be tied round them, or by raising the lower jaw, the teeth may be made to retain the tongue in that position. Remove all tight clothing from about the neck and chest, especially the braces.

“To Imitate the Movements of Breathing.”—Standing at the patient's head, grasp the arms just above the elbows, and draw

FIG. 27.



RESTORATION OF APPARENTLY DROWNED.—INSPIRATION.
(Sylvester's Method.)

FIG. 28.



RESTORATION OF APPARENTLY DROWNED.—EXPIRATION.
(Sylvester's Method.)

the arms gently and steadily upwards above the head, and *keep them stretched* upwards for two seconds. (*By this means air is drawn into the lungs.*) Then turn down the patient's arms, and press them gently and firmly for two seconds against the sides of the chest. (*By this means air is pressed out of the lungs.*)

“Repeat these measures alternately, deliberately, and perseveringly, about fifteen times in a minute, until a spontaneous effort to respire is perceived, immediately upon which cease to imitate the movements of breathing, and proceed to induce circulation and warmth.

“**Treatment after Natural Breathing has been Restored.**—*To promote Warmth and Circulation.*—Commence rubbing the limbs upwards, with firm grasping pressure and energy, using handkerchiefs, flannels, &c. (*By this measure the blood is propelled along the veins towards the heart.*)

“The friction must be continued under the blanket or over the dry clothing.

“Promote the warmth of the body by the application of hot flannels, bottles, or bladders of hot water, heated bricks, &c., to the pit of the stomach, the armpits, between the thighs, and to the soles of the feet.

“If the patient has been carried to a house after respiration has been restored, be careful to let the air play freely about the room.

“On the restoration of life, a teaspoonful of warm water should be given; and then, if the power of swallowing have returned, small quantities of wine, warm brandy-and-water, or coffee should be administered. The patient should be kept in bed, and a disposition to sleep encouraged.

“*General Observations.*—The above treatment should be persevered in for some hours, as it is an erroneous opinion that persons are irrecoverable because life does not soon make its appearance, persons having been restored after persevering for many hours.

“*Appearances which generally accompany Death.*—Breathing and the heart's action cease entirely; the eyelids are generally half closed; the pupils dilated; the tongue approaches to the under edges of the lips, and these, as well as the nostrils, are covered with a frothy mucus. Coldness and pallor of surface increase.

“*Cautions.*—Prevent unnecessary crowding of persons round the body, especially if in an apartment.

“Avoid rough usage, and do not allow the body to remain on the back unless the tongue is secured.

“Under no circumstances hold the body up by the feet.

“On no account place the body in a warm bath unless under

medical direction, and even then it should only be employed as a momentary excitant."

ACCIDENTS TO SAILS AND SPARS.

The Sheet of a Square Sail carried away.—Haul up on the clewline and buntlines; then lower the yard (if an upper yard or a royal), but do not lower until the gear is hauled up, as by keeping the yard up there is less to knock about; repair the sheet, and reset the sail.

Downhaul of a Jib carried away.—Give the ship a wipe off, so as to calm the sail, and send hands out to haul it down by hand; if the weather be too bad for this, set sail again, and take a line up; before all, make a bowline on the stay, and use it as a down-haul.

Brace carried away.—Keep ship off before the wind, take in sail (if necessary), and repair the damage.

Sheet of Head Sail carried away.—Run the ship off a point or two, and haul sail down as quickly as possible; bend new sheet, and reset the sail.

If a **parrel is carried away**, or comes adrift, lay the sail aback, thereby binding the yard to the mast, and fit another parrel.

If a **spar is carried away aloft**, it will be necessary at once to secure any other spars or braces that depend upon it for support, and also to get the broken spars down from aloft as quickly as possible, since, if allowed to bang about, they may do much damage. It is a very useful precaution to have a line always handy, especially in bad weather; this can be taken aloft at once, and used as a gantline (without the necessity of opening hatches) for lowering down the damaged spars.

If any of the spars hang over the side, and endanger the safety of the ship by banging against her side, and should the weather be too bad to save them, they should at once be cut away.

If the **Lower Lift is carried away**, and with it probably the topsail sheet, secure the topsail, brace the lower yard against the rigging, reeve new lift, and reset the sails.

If a yard gets **sprung** it may be repaired by fishing—that is, placing pieces of wood round the wounded part, securing them with wire or chain lashing, and well wedging all up when finished.

Taken aback.—It is very seldom that a watchful officer will be taken aback; but should this happen, the ship must be prevented from getting stern way, as, if the sea is bad, the results of stern way are likely to be disastrous. Suppose the ship is going along with the wind on the port quarter, and she is taken aback with the wind on the starboard beam, the head yards should be hauled round at once on the starboard tack, then the after yards. If the wind suddenly shifts from the port beam to the starboard bow put

the helm down, brace round the after yards, then the head yards, and bring her to her course again.

A sudden hard Squall strikes the Ship.—If the wind is before the beam luff up to it, and shake it out of her; if abaft the beam, up helm and wipe her off a point or two. It is very dangerous to try to get the ship off the wind, if the wind is before the beam, unless the squall gives sufficient warning before it strikes the ship, as, owing to the ship lying over so much, the rudder has little power, and yards will not come down when the halliards are let go, the great inclination of the masts as she lies over preventing the yards running down.

INSTRUCTIONS FOR THE GUIDANCE OF MASTERS AND SEAMEN WHEN USING THE MORTAR AND ROCKET LINES FOR SAVING LIFE FROM SHIPWRECK.

In the event of your Vessel stranding on the Coasts of the United Kingdom, and the lives of the crew being placed in danger, assistance will, if possible, be rendered from the shore in the following manner, namely:—

1. A rocket or shot, with a thin line attached, will be fired across your vessel. Get hold of this line with all speed; and when you have secured it, let one of the crew be separated from the rest, and signal to those on shore as follows:—IF IN THE DAY-TIME, wave his hat or his hand, or a flag or handkerchief; OR, IF AT NIGHT, let a rocket, blue light, or a gun be fired, or let a light be shown over the side of the ship, and be again concealed.

2. When you see one of the men on shore separated from the rest, wave a RED FLAG; or, if at night, show a RED LIGHT, and then conceal it. You are to haul upon the ROCKET LINE until you get a tailed block with an endless fall rove through it.

3. Make the tail of the block fast to the mast about 15 FEET ABOVE THE DECK, or, if your masts are gone, to the HIGHEST SECURE part of the vessel; and when the tail block is made fast, and the ROCKET LINE UNBENT FROM THE WHIP, let one of the crew, separated from the rest, make the signal required by Article 1 above.

4. As soon as the signal is seen on shore, a hawser will be bent to the whip line, and will be hauled off to the ship by those on shore.

5. When the hawser is got on board, the crew should at once make it fast to the same part of the ship as the tailed block is made fast to, only about 18 INCHES HIGHER, taking care that there are NO TURNS OF THE WHIP LINE ROUND THE HAWSER.

6. When the hawser has been made fast on board, the signal directed by Article 1 above is to be repeated.

7. The men on shore will then pull the hawser taut; and, by means of the whip line, will haul off to the ship a sling, cot, or life buoy, into which the person to be hauled ashore is to get and be made fast. When he is in and secure, one of the crew must be separated from the rest, and again signal to the shore as directed in Article 1, above. The people on shore will then haul the person in the sling to the shore; and, when he has landed, will haul back the empty sling to the ship for others. This opera-

tion will be repeated to and fro until all persons are hauled ashore from the wrecked vessel.

8. It may sometimes happen that the state of the weather and the condition of the ship will not admit of a hawser being set up; in such cases a sling or life-buoy will be hauled off instead; and the persons to be rescued will be hauled through the surf instead of along the hawser.

Masters and crews of stranded vessels should bear in mind that success in landing them, in a great measure, depends upon their coolness and attention to the rules here laid down, and that by attending to them many lives are annually saved by the mortar and rocket apparatus on the coasts of the United Kingdom.

The system of signalling must be strictly adhered to; and all women, children, passengers, and helpless persons should be landed before the crew of the ship.—BOARD OF TRADE.

USE OF OIL FOR MODIFYING THE EFFECT OF BREAKING SEAS.

The Board of Trade calls the attention of officers to the fact "that a very small quantity of oil, skilfully applied, may prevent much damage both to ships (especially the smaller classes) and to boats, by modifying the action of broken or troubled waters." The principal facts as to the use of oil are as follows:—

1. On free waves—*i.e.*, waves in deep water—the effect is greatest.
 2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain; as nothing can prevent the larger waves from breaking under such circumstances; but even here it is of some service.
 3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when nothing else is obtainable; but all animal and vegetable oils, such as waste oil from the engines, have great effect.
 4. A small quantity of oil suffices if applied in such a manner as to spread to windward.
 5. It is useful in a ship or boat, both when running or lying to, or in wearing.
 6. No experiences are related of its use when hoisting a boat up in a sea-way at sea, but it is highly probable that much time and injury to the boat would be saved by its application on such occasions.
 7. In cold water, the oil, being thickened by the lower temperature, and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.
 8. The best method of application in a ship at sea appears to be: hanging over the side, in such a manner as to be in the water, small canvas bags, capable of holding from one to two gallons of oil, such bags being pricked with a sail needle to facilitate leakage of the oil.
- The position of these bags should vary with the circumstances. Running before the wind they should be hung on either bow—*e.g.*, from the cathead—and allowed to tow in the water.

With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying-to, the weather bow and another position farther aft seem the

best places from which to hang the bags, with a sufficient length of line to permit them to draw to windward while the ship drifts.

9. Crossing the bar with a flood tide, oil poured overboard and allowed to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances, the effect cannot be so much trusted.

On a bar with the ebb tide it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current, and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil is diffused well ahead of the boat, and the bag can be readily hauled on board for refilling if necessary.

PART V.

SIGNALS AND SIGNALLING—RULE OF THE ROAD.

SIGNALS AND SIGNALLING.

SIGNALS of various kinds are used by ships to communicate with another vessel out of hailing distance.

(1) **Daylight signalling** is conducted by means of sets of coloured flags. By a single flag using Morse code. By various shapes for distant signalling. By movable arms fitted to a mast and worked by levers, called a semaphore; or by sound (whistle or syren using Morse code). (2) **Night signalling** is conducted by means of a flashing lamp and with Morse or other code, and by sound signals.

Until quite recently coloured flags alone were used but the rapid movements of steamers and the necessity of communicating quickly, both by day and night, has brought the Morse Code into use. It will probably in time supersede the other methods of signalling for ordinary purposes. A great advantage in favour of the Morse code is its adaptability for either day or night signalling (by flashes of light or sound) and the convenience with which it may be used when away in boats, or on land.

COMMERCIAL CODE OF SIGNALS.

The International Code is the one in most general use; it consists of nineteen flags, from combinations of which it is possible to form over 70,000 signals.

By dividing these combinations into sets, it is possible to classify the signals as follows:

One flag signals:

As C = assent or yes. D = negative or no.

Two flag signals :

Burgee uppermost = Attention signals.

As BD. = What ship is that ?

Pennant C, D, F, or G uppermost = compass signal.

As GR. = N.N.W.

Square flag uppermost = urgent signal.

As JD. = You are running into danger.

Three flag signals :

These are general signals and relate to latitude, longitude, time, &c.

As {	F. H. G.	60° latitude.
	G. S. T.	10 A.M.

Four flag signals :

As names of men-of-war with the pennant G uppermost.

Names of merchant ships with a square flag uppermost.

Spelling or vocabulary signals, have pennants C, D, or F uppermost.

Geographical signals have burgee uppermost.

Signalling should be conducted smartly. Double halliards should always be fitted to the gaff end, which, when not in use, should be made fast to the tack of the driver, or spanker, or in a steamer to the signal stay over the bridge ; and the signal locker should be close at hand. When much signalling is being done a board with hooks for each flag is very convenient.

Plates XI. and XII illustrate signals of all kinds.

DISTRESS SIGNALS.

A continuous sounding with any fog-signal apparatus.

Daylight :

1. Ensign flying with Jack down.
2. Code signal N. C.
3. A square flag with a ball above or below it.
4. A minute gun or explosive signal.

Night.

1. A burning tar-barrel.
2. A minute gun or explosive signal fired at intervals.

PILOT SIGNALS.**By day.**

1. The pilot Jack at the fore.
2. The Code signal P. T.

At night.

1. A blue light every fifteen minutes.
2. A white light shown at frequent intervals.

NATIONAL .
Red Ensign



MERCANTILE MARINE
ENGLISH



NATIONAL
U.S.AMERICA



NATIONAL
FRANCE



GERMANY



NORWAY



Ensign.
MAN OF WAR & MERCHANT
BELGIUM



SWEDEN



DENMARK



Ensign
MAN OF WAR & MERCHANTS
HOLLAND



AUSTRIA



ITALY



RUSSIA



SPAIN



Ensign
BRAZIL



GREECE



JAPAN

MERCHANT NAVY FLAGS.

the which will be found to
 cutting each long hair

Minocutting

Span
 course



all Stages








if the heavy
 from Jack

Interrogative

Wendell

Atkinson

ROYAL NAVY	
Alphabetical	Semaphore
	
A  Line Ahead	1
B  Line Abreast Boats Recall	
C  Quarter Line Coast Guard	
D  Pilot Jack	
E  Semaphore	
F  Plague Manoeuvring Semaphore	
G  Turning	
H  Torpedo	
I  Watch	
J  Torpedo Vessels	
K  Torpedo Vessels	
L  Torpedo Boats	

GENERAL	
International Code Signal and Answering Pendant	Morse
	
 Yea	
 No	
 Yea	
 No	
 Yea	
 No	

M  Starboard	↗
N  Port	↑
O  Optional	↖
P  Auxiliary Signal Boat	↘
Q  Steer the same Course	↗
R  Detached Squadron	↖
S  Cruisers	↘
T  Transport	↗
U  Colliers	↖
V  Reform	↘
W  Ahead	↗
X  Astern	↖
Y  Abeam	↘
Z  Quarterly	↗

 Blue Peter	
 Blue Peter	
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 Blue Peter	
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 Blue Peter	

NUMERICAL & SPECIAL FLAGS

Numerical	Pendant
1  Fleet Manual	 Single Line
2  Repeat	 Divisions
3  Alphabetical	 Subdivisions
4  Special	 General Recall
5  Latitude & Longitude	
6  Military	
7  Honorary	
8  Close	
9  Open	
0  Open	

VARIOUS

 Admiralty	 Preparative	 Disregard	 Affirmative
 Military	 Church Pendant	 Blue Pendant	 Officers Pendant
 Diplomatic	 Answering Pendant	 Interrogative Pendant	 Negative
 Broad Pendant	AUXILIARY MORSE		
 Blue Ensign	 Auxiliary Signal Book		
 Consular	 Pendants		
 Naval Ordnance	 Numerical		
	 Honorary		
	 Military and etc Coast Guard		
	 List of the Navy or Union Jack		
	 Sail Signal		
	 N° 9 Pent Course		
	 Manoeuvring		

In this sheet the flags, &c., representing a letter are placed in the same horizontal line; the numerical flags are similarly arranged. In the Morse Alphabet a Sight system is adopted: the lengths of the flashes are shown by long and short reds, which will be found to be true in position if the letters are made as in ordinary use (except Q); the flashes are also given in red following the letters. The position and lengths of the flashes quickly impress themselves on the eye; help is also afforded by treating each long flash as $\bar{1}$ and each short one as $\bar{1}$, thus in P we get Pilli (pilli), Will (will).

SAILING SIGNAL.

Blue Peter at the fore.

MORSE CODE.

The **Morse Code** is rapidly coming into favour on account of the ease with which it can be communicated either by sight or sound. For signalling by sight in the daytime, a flag on a short staff is used. The signaller can stand in any position he likes, having due regard to the ease with which the person he is signalling to can read his signals. In the daytime for a dot (·) the flag or staff should be moved smartly across the body from one shoulder to the other, describing an arc of about 50° ; for a dash (—) it should be moved from one shoulder over the opposite side of the body, making an arc of 150° , the flag being held all the time well above the head.

At the end of each word push the flag up perpendicularly over the head. In using the lamp at night time, see that you point the lamp correctly. The length of exposure of the light for the dash (—) should be three times as long as that for the (·); make a slightly longer pause at the end of each word. A very ingenious method of learning the Morse Code has been brought to my notice by Mr. R. C. Buck (Headmaster of the Incorporated Thames Nautical Training College, H.M.S. *Worcester*) and reproduced here in the plate, in which in learning the Code, the memory is assisted by the sight.

The Morse Code is extremely useful and should be learnt by every young sailor, as it offers such an expeditious and easy method of signalling, not only in the day, but also at night.

RULE OF THE ROAD.

The Rule of the Road has been formulated to enable vessels to navigate the sea expeditiously and safely, without coming into collision; it has been elaborated from a few rules accepted by custom, and dating from the early days of sailing ships.

The rules may be stated as follows:

(1) A vessel at anchor (whether steam or sailing) shall exhibit at night time a white light not less than 20 feet above the hull, in such a position as to give a uniform light all round, and visible in clear weather at a distance of at least one mile. To attain these requirements, the light is generally hung in the fore rigging.

(2) Sailing vessels when under way (either sailing or being towed) shall exhibit a green light on the starboard side of the

vessel, and a red light on the port side; and shall have a white light, or flare up, ready to show over the stern to an overtaking vessel.

(3) A steamer, when under way, shall carry, in addition to the coloured lights, a white mast-head light in front of the foremast, at a height not less than 20 feet above the hull. Should the beam of the vessel exceed 20 feet, the white light must be carried at a height not less than the beam. A white light or flare up should be in readiness to exhibit over the stern to an overtaking vessel.

(4*) Each coloured or side light shows over an area of ten points, that is from right ahead of the vessel to two points abaft the beam, and the masthead light shows from right ahead to two points abaft the beam on both sides; thus showing over twenty points of the compass.

The coloured lights should be visible in clear weather to a distance of at least two miles and the mast-head light in clear weather to a distance of at least five miles.

(5) Steam vessels when under sail only, or when being towed, carry the side-lights only.

(6) A steamer towing another vessel shall carry, in addition to the ordinary lights, a white light under the mast-head light at a distance below it of not less than three feet.

(7) **Sailing pilot vessels** when engaged on pilotage duty shall carry a white mast-head light visible all round the horizon, and shall exhibit a flare up every fifteen minutes.

Steam pilot vessels when on duty shall carry, in addition to the white mast-head light, a red light, eight feet below it, visible all round the horizon at a distance of not less than two miles on a clear night. They shall also carry the coloured side lights. When steam pilot vessels are at anchor, they shall exhibit only the white and red mast-head lamps.

Pilot vessels under way, and not on duty, shall carry the ordinary lights.

(8) Telegraph ships when under way, or at work on cables, shall carry in addition to the coloured side lamps, three mast head lights in a vertical line, and not less than six feet apart. The highest and lowest of these lights shall be red, and the centre one white.

In the day time these mast-head lights are replaced by shapes, not less than two feet in diameter, the red lights by red globular shapes; and the white light by a white diamond shape.

(9) A vessel not under command will carry at night time, three

* For the exact arc over which the light shows, see *The Board of Trade Regulations*.

red mast-head lights in a vertical line, not less than three feet apart, and these lights should be visible at a distance of not less than two miles on a clear night.

By day these lights shall be replaced by black balls, or shapes not less than two feet in diameter.

(10) Neither telegraph ships, nor ships not under command, carry side-lights, unless they are making way through the water.

(11) In fogs, mist, falling snow, or at any time when it is impossible to distinguish objects not quite close, a ship should proceed at a moderate speed (four knots) and a steam vessel should sound her whistle or syren at least every two minutes. A sailing vessel should use her fog-horn in the same manner.

At anchor all vessels should ring a bell every two minutes.

(12) It is customary for a sailing vessel to sound two blasts on her fog-horn, when on the port tack; one blast, when on the starboard tack; and three blasts, when the wind is abaft the beam.

In steamers one short blast means, "I am directing my course to starboard"; two short blasts, "I am directing my course to port"; and three short blasts, "I am going full speed astern."

(13) In going through narrow channels keep to the right, as in walking.

(14) One vessel overtaking another keeps out of its way.

(15) In very small vessels it is permissible to keep the side-lights on deck in bad weather, as it is then difficult to keep them in their places; but they should be ready for instant use. In some cases a lamp having a green glass on one side and a red glass on the other is permissible, but care should be taken to exhibit the lights on the proper side.

(16) **Steam trawlers** when not stationary and engaged in trawling are required to carry either:

1. The usual side-lights and mast-head light; or—

2. In place of the mast-head light, a lamp so constructed with shades, that it shows a white light right ahead and two points on either bow: a green light from two points on starboard bow to four points abaft the starboard beam, and a red light which shows from two points on the port bow to four points abaft the port beam. Under this lamp, at a distance of not less than six feet, and not greater than twelve feet, a white light shall be carried, so constructed as to show an unbroken light all round the horizon.

(17) **Sailing trawlers** when engaged in trawling and not stationary shall carry:

1. Ordinary side-lights; or—

2. A mast-head lamp showing a green light on the starboard

side from right ahead to four points abaft the starboard beam ; and a red light on the port side showing over a similar arc ; and under the lamp, at a distance of not less than six feet, or greater than twelve feet, a white light showing an unbroken light all round the horizon.

(3) A white mast-head light showing an unbroken light all round the horizon and visible on a clear night, for at least two miles. As a warning to a vessel approaching, a coloured light burning for at least 30 seconds should be exhibited in time to prevent collision.

(18) Vessels engaged in **drift net fishing** shall carry two vertical white lights hung on any part of the vessel with a vertical distance between them of not less than six feet, or greater than 10 feet ; and a horizontal distance between them, measured in the fore-and-aft line of the vessel, of not less than 5 feet or greater than 10 feet. The lamps shall be so hung as to show a uniform light all round the horizon ; and be visible in clear weather at least 3 miles.

(19) Vessels engaged in **line fishing** carry the same lights as those engaged in **drift net fishing**.

(20) Should a fishing vessel become stationary, through her gear catching an obstruction, she shall exhibit the ordinary anchor light ; or if in a fog, or mist, she shall sound the bell.

(21) Fishing vessels, when at work in a fog or mist, are required to sound a fog-horn and ring a bell alternately every two minutes.

FOR SAILING VESSELS.

A vessel running free should keep out of the way of a vessel **close hauled**.

A vessel sharp up on the port tack, keeps out of the way of a vessel sharp up **on the starboard tack**.

A steamer keeps out of the way of a sailing ship, unless the sailing **ship is overhauling** the steamer.

When two vessels are meeting, with the wind free in both cases, the vessel on the port tack keeps out of the way of the vessel on the starboard tack.

FOR STEAM VESSELS.

Two vessels meeting end on, both alter their course to starboard, **passing port side to port side**.

A steamer which has the other steamer on her own starboard **side, keeps out of the way**.

A steamer keeps out of the way of a sailing vessel, unless the latter be the overtaking ship.

AIDS TO MEMORY IN FOUR VERSES.

By THOMAS GRAY, C.B.

I. Two steam vessels meeting—

When all three lights you see ahead
Port your helm and show your *Red*.

II. Two steam ships passing—

Green to Green—or Red to Red—
Perfect safety—go ahead.

III. Two steam ships crossing—

If to starboard *Red* appear
'Tis your duty to keep clear ;
To act as judgment says is proper,
To *Port*—or *Starboard*—Back—or stop her !

But when upon your port is seen
A steamer's starboard light of *Green*,
There's not so much for you to do,
As Green to port keeps clear of you.

This is the position of greatest danger.

IV. All ships must keep a good look out, and steamers must stop and go astern if necessary.

Both in safety and in doubt
Always keep a good look-out ;
In danger, with no room to turn,
Ease her—stop her—go astern.

The officer on watch on sighting a light should endeavour at once to ascertain by change of bearing the direction in which the vessel carrying it is going, and should not touch the helm of the vessel he is in charge of until he can do so with confidence. Collisions are generally caused by the vacillating conduct of one of the vessels.

The vessel that holds on by right should stop or go astern in preference to altering her helm.

PART VI.

MISCELLANEOUS.

NOTES ON POINTS OF ETIQUETTE: KEEPING
AND RELIEVING WATCH, ETC.

To some persons attention to the smaller points of etiquette may appear a trivial matter; but it is a wonderful strengthener of discipline, and ought not to be neglected on board ship. The fact is too often lost sight of, that an officer who has to work hard does not on that account lose dignity, and his natural power of command, unless he wills it so. Work properly done adds to, instead of diminishing, a man's dignity and position.

On going aboard a ship at any time, the good old custom of saluting the quarter-deck should be carried out. In all mail steamers, and in many other vessels, a quarter-master is at the gangway to receive visitors, and he will return the salute. The customary salute of the Service now is to bring up the hand, with the thumb and fingers straight and close together, to the cap smartly and naturally, the thumb being in line with the outer edge of the right eyebrow, and the palm of the hand inclined to the left. Officers should always salute when addressing the captain, who will return the salute.

Officers when relieving one another should salute; and the officer being relieved should satisfy himself that his relief understands the course, and that at night time he signs the night order-book.

The **night order-book** is taken to the captain at or about 8 P.M.; at the same time the boats, fire-hoses, &c., should be reported "all clear and ready for immediate use." The captain will write up the night orders and return the book to the officer of the watch.

It must be remembered that in a steamer, the Deck Department is responsible for the discipline of the ship, and it should ever be the desire of that department to work amicably with the Engine-room Department. Splashing water into the engine-room, besides

being very dangerous, is as annoying to those working below as the upsetting of ashes, the spilling of oil, and dirty boots are to those in charge of the cleanliness on deck. Complaints of these kinds may easily be avoided by a little consideration on both sides, and a decided wish to work in the interests of the ship. Any request for steam on the winches, or windlass, or for water for washing decks, should be sent to the engineer on watch, and, when finished with, a message should also be sent down to him.

The quarter-master, or whoever strikes the bells at night time, should see that the lights are burning brightly, and the look-out man on the forecastle should sing out "All's well," to show he is on the *qui vive*.

On no account should the **officer on watch**, or **look-out man**, leave the bridge in a steamer unless relieved.

In most modern ships the officer on watch can communicate with the captain by telephone, or speaking-tube, without leaving the bridge or poop. The movement of the barometer (which should be hung in the chart-house on the bridge) should be noted, and when near land; the chart, which in many vessels is in a case on the bridge, should be continually consulted.

The officer on watch should on no account ever pass a point of land, island, rock, or light without determining the distance he will pass off before he gets abreast, and the distance he actually passes off when abreast.

In a sailing vessel it is often necessary to move about the deck, to see the sails trimmed properly.

The officer of the watch should frequently look at his compass; and if the compass used for steering by is not the standard compass, it should be frequently compared with the latter.

The spare set of lights should be ready.

Above all things, the officer on watch should be ever vigilant and alert, and ready to act in a moment.

If in any doubt that things are not as they should be, he must not hesitate to call the captain.

MAXIMS.

- I. See all clear before dark.
- II. A place for everything and everything in its place.
- III. He who strives the tempest to disarm
Should never first embraile the lee yard-arm.
- IV. With the rain before the wind,
Your tops'l halliards you must mind.
But with the wind before the rain,
Your tops'ls you can hoist again.
- V. If clouds are gathering thick and fast
Look out sharp for sail and mast ;
But, if they lag upon the road,
Keep your flying kites abroad.
- VI. The evening red and the morning grey,
Are sure signs of a fine day ;
But, the evening grey and morning red,
Make the sailor shake his head.
- VII. See everything as you pass it.

A GLOSSARY

OF

SEA TERMS AND PHRASES.*

A.—The class of the excellence of sea-going merchant ships on Lloyds' books, sub-divided into 100 A., 90 A., &c., 100 A. being the highest class. The difference is chiefly due to thickness of plating, or to age. A small letter inside the A., thus **A** or **A**, indicates a finer classification of each section in accordance with certain rules laid down. Coasting vessels and special service vessels are classed under different characters.

A. B.—The rating of able seamen on the ship's books; these two letters are often used as an epithet for the person so rated. He must be equal to all the duties required of a seaman in a ship, not only as regards the saying "to hand, reef, and steer," but also to strop a block, splice, knot, turn in rigging, and be an example to the ordinary seaman and landsman.

Aback.—The situation of a ship's sails when the wind bears against their front surfaces.

Abaft.—This word, generally speaking, means behind, inferred relatively, beginning from the stem, and continuing towards the stern, that is, the hinder part of the ship. Abaft the beam implies any direction between a supposed transverse line amid-ships and the stern, whether in or out of the ship. It is the relative situation of an object with the ship, when that object is placed in the arc of the horizon contained between a line at right angles with the keel and the point of the compass, which is directly opposite the ship's course. An object—as a man overboard—is described by the look-out man at the mast-head as abeam, before, or abaft the beam, by so many points of the compass; or as a vessel seen, may be "three points before the beam," &c.

Abeam.—In a line at right angles to the vessel's length; opposite the centre of a ship's side.

Abreast.—Side by side, parallel, or opposite to; generally used in opposition to abaft or afore. Abreast of a place is directly off it, a direction at right angles with the keel or ship's length.

A-Burton.—The situation of casks when they are stowed in the hold athwartship, or in a line with the beam.

* By kind permission of Messrs. Blackie & Son, I am able to make many extracts from Admiral Smyth's admirable "Sailor's Word Book."

A-Cockbill.—When the anchor hangs by its ring at the cat-head in a position for dropping.

Adrift.—Floating at random ; the state of a boat or vessel broken from her moorings, and driven to and fro without control by the winds and waves. Cast loose, cut adrift.

Afloat.—Borne up and supported by the water ; buoyed clear of the ground ; also used for being on board ship.

Aft.—Contra-distinctive of fore, and an abbreviation of abaft—the hinder part of the ship, or that nearest the stern. Right aft is in a direct line with the keel from the stern. To haul aft a sheet is to pull on the rope which brings the clew, or corner, of the sails more in the direction of the stern. The mast rakes aft when it inclines towards the stern.

Aground.—The situation of a ship or other vessel whose bottom touches or rests upon the ground. It also signifies stranded, and is issued figuratively for being disabled or hindered.

Ahead.—A term especially referable to any object farther onward, or immediately before the ship, or in the course steered, and therefore opposed to astern. Ahead of the reckoning is sailing beyond the estimated position of the ship.

A-lee.—The contrary of a-weather ; the position of the helm when its tiller is borne over to the lee-side of the ship, in order to go about or put her head to windward. “Hard a-lee!” or “luff a-lee!” an order to the steersman to put the helm down. “Helm’s a-lee!” the word of command given on putting the helm down, and causing the head-sails to shake in the wind.

Aloft.—Above, over-head, on high. Synonymous with up above the tops, at the mast-head, or anywhere about the higher yards, masts, and rigging of ships. “Aloft there!” the hailing of people in the tops. “Away aloft!” the command to the people in the rigging to climb to their stations.

Amid-Ships.—The middle of the ship, whether in regard to her length between stem and stern, or in breadth between the two sides. To put the helm amid-ships is to place it in a line with the keel.

Anchor-Watch.—A sub-division of the watch kept constantly on deck during the time the ship lies at single anchor to be in readiness to hoist jib or stay-sails, to keep the ship clear of her anchor ; or in readiness to veer more cable, or let go another anchor in case the ship should drive or part from her anchor.

Angle-Irons.—Certain strips of iron having their edges turned up at an angle to each other ; they are of various sizes, and used for the ribs and knees of the framing of iron vessels.

Apeek.—A ship drawn directly over the anchor is apeek ; when the fore-stay and cable form a line, it is “short stay” apeek ; when in a line with the main stay, “long stay” apeek. The anchor is apeek when the cable has been sufficiently hove in to bring the ship over it. Yards are apeek when they are topped up by contrary lifts.

Articles.—The express stipulations to which seamen bind themselves by signature on joining a merchant ship.

Astern.—Any distance behind a vessel ; in the after-part of the ship ; in the direction of the stern, and therefore the opposite of “ahead.” To

drop astern is to be left behind ; when abaft a right angle to the keel at the main-mast she drops astern.

Athwart.—The transverse direction ; anything extending across the line of a ship's course. "Athwart hawse," a vessel, boat, or floating lumber accidentally drifted across the stem of a ship, the transverse position of the drift being understood. "Athwart the forefoot," just before the stem ; ships fire a shot in this direction to arrest a stranger, and make her bring-to. "Athwart ships," in the direction of the beam ; from side to side ; in opposition to "fore and aft."

A-trip.—The anchor is a-trip, or a-weigh, when the purchase has just made it break ground, or raised it clear. Sails are a-trip when they are hoisted from the cap, sheeted home, and ready for trimming.

Avast.—The order to stop, hold, cease, or stay, in any operation.

Avast Heaving.—The cry to arrest the capstan or winch when nippers are jammed, or any other impediment occurs when heaving in the cable or rope.

A-Weather.—The position of the helm when its tiller is moved to the windward side of the ship, in the direction from which the wind blows. The opposite of "A-lee."

A-Weigh.—The anchor being a-trip, or after breaking out of the ground.

Aye, Aye, Sir.—A prompt reply on receiving an order. Also the answer on comprehending the order.

Back.—To "back an anchor" is to carry a small anchor ahead of the one by which the ship rides, to partake of the strain, and check the latter from coming home. To "back and fill," is to get to windward in very narrow channels, by a series of smart alternate boards and backing, with weather tides. To "back a sail," is to brace its yard so that the wind may blow directly on the front of the sail, and thus retard the ship's course. A sailing vessel is "backed" by means of the sails, a steamer by reversing the paddles or screw-propeller. To "back astern." To impel the water with the oars contrary to the usual mode, or towards the head of the boat, so that she shall recede. To "back the port or starboard oars." To back with the right or left oars only, so as to round suddenly. To "back out." This term is familiarly used for retreating out of a difficulty. To "back a rope or chain," is to put on a preventer when it is thought likely to break from age or extra strain. To "back water." To impel a boat astern, so as to recede in a direction opposite to the former course.

Baffling.—A term applied to the wind when it frequently shifts from one point to another.

Ballast.—A certain portion of stone, pig-iron, gravel, water, or such like materials, deposited in a ship's hold when she either has no cargo or too little to bring her sufficiently low in the water. It is used to counter-balance the effect of the wind upon the masts, and to give the ship a proper stability, that she may be enabled to carry sail without danger of overturning.

Ballast Ports are square holes cut in the sides of vessels for taking in ballast. They should be securely barred and caulked in before proceeding to sea.

Bank Fires, To.—In steamers, allowing the fires to burn down low, pulling them down to one side of the bridge of the fireplace, and there covering them up with ashes taken from the ash-pit, at the same time nearly closing the dampers in the funnel and ash-pit doors. This, with attention on the part of the engineers, will suffice to maintain the water hot, and a slight pressure of steam in the boilers. When fuel is added and draught induced the fires are said to be “drawn forward,” and steam is speedily generated.

Baréca.—A small barrel.

Bare Poles.—The condition of a ship having no sails set when out at sea, and either scudding, or lying-to, by stress of weather.

Barratry.—Any fraudulent act of the master or mariners committed to the prejudice of the ship's owners or underwriters, whether by fraudulently losing the vessel, deserting her, selling her, or committing any other embezzlement. The diverting a ship from her right course with evil intent is barratry.

Battens.—In general, scantlings of wood from 1 inch to 3 inches broad. Long slips of fir used for setting fair the sheer-lines of a ship, drawing the lines by in the moulding loft, or setting off distances. Also, thin strips of wood put upon rigging, to keep it from chafing, by those who dislike mats; when large these are designated “Scotchmen.”

Battens of the Hatches.—Long narrow laths of wood or iron, serving by the help of wedges to confine the edges of the tarpaulins, and keep them close down to the sides of the hatchways, in bad weather.

Beacon.—A post or stake erected over a shoal or sandbank, as a warning to seamen to keep at a distance; also a signal mark placed on the top of hills, eminences, or buildings near the shore for the safe guidance of shipping.

Beam-Ends.—A ship is said to be on her beam-ends when she has heeled over so much on one side that her beams approach to a vertical position; hence also a person lying down is metaphorically said to be on his beam-ends.

Beating, or Turning to Windward.—The operation of making progress by alternate tacks at sea against the wind, in a zig-zag line, or transverse courses; “beating,” however, is generally understood to be turning to windward in a storm or fresh wind.

Becalm, To.—To intercept the current of the wind in its passage to a ship, by means of any contiguous object, as a high shore, some other ship to windward, &c. At this time the sails remain in a sort of rest, and are consequently deprived of their power to govern the motion of the ship. Thus one sail becalms another.

Before or Aft the Beam.—The bearing of any object which is before or aft a line at a right angle to the keel, at the midship section of a ship.

Belaying Pins.—Small wooden or iron cylinders, fixed in racks in different parts of the ship, for belaying running ropes to.

Bell.—“Strike the bell.” The order to strike the clapper against the bell as many times as there are half-hours of the watch elapsed; hence we say it is two bells, three bells, &c., meaning there are two or three half-hours past.

Belly.—The swell of a sail. To belly a sail is to inflate or fill it with the wind, so as to give it a taut leech.

Bend, To.—To fasten one rope to another, or to an anchor, &c.

Bibbs.—Pieces of iron or steel bolted to the hounds of a mast, to support the trestle trees.

Bight.—The loop of a rope when it is folded; in contradistinction to its ends.

Bilge or Bulge.—That part of the floor in a ship—on either side of the keel—which approaches nearer to a horizontal than to a perpendicular direction, and begins to round upwards.

Bilge Keels are keels bolted on to the bilge of many vessels to make them easier in a seaway by preventing excessive rolling.

Bill of Exchange.—A means of remitting money from one country to another. The receiver must present it for acceptance to the parties on whom it is drawn without loss of time; he may then claim the money after the date specified on the bill has elapsed.

Bill of Health.—A certificate properly authenticated by the consul or other proper authority at any port, that the ship comes from a place where no contagious disease prevails, and that none of the crew, at the time of her departure, were infected with any such disease. Such constitutes a *clean* bill of health, in contradistinction to a *foul* bill.

Bill of Lading.—A memorandum by which the master of a ship acknowledges the receipt of the goods specified therein, and promises to deliver them, unless the dangers of the sea, fire, or enemies prevent him, in like good condition, to the consignee, or his order.

Bill of Sale.—A written document by which the property of a vessel, or shares thereof, are transferred to a purchaser.

Binnacle.—The case in which the compass is kept to preserve it from injury.

Binnacle Light.—The oil or electric lamp which illuminates the compass card in the binnacle.

Bitts.—A frame composed of two strong pieces of straight oak timber, fixed upright in a ship, and bolted securely to the beams, whereon to fasten the cables or other ropes; also iron or steel cylindrical castings bolted in places about the decks.

Blacking Down.—The tarring and blacking of rigging; or the operation of blacking the ship's sides with tar or mineral blacking.

Block and Block.—The situation of a tackle when the blocks are drawn close together.

Blue Pigeon.—A nickname for the sounding lead.

Board.—The space comprehended between any two places when the ship changes her course by tacking; or, it is the line over which she runs between tack and tack when working to windward, or sailing against the direction of the wind. To make "a good board." To sail in a straight line when close hauled, without deviating to leeward. To make "short boards," is to tack frequently before the ship has run any great length of way. To make a "stern board," is when by a current, or any other accident, the vessel comes head to wind, the helm is shifted, and she has fallen back on the opposite tack, losing what she had gained, instead of

having advanced beyond it. (See *Stern Board*.) The word board has various other applications among seamen. To "go aboard" signifies to go into the ship. To "slip by the board" is to slip down a ship's side. To "board it up," is to beat up, sometimes on one tack, and sometimes on another. The "weather-board" is the side of the ship which is to windward. "By the board," means close to a ship's deck.

Boat-chocks.—Clamps of wood upon which a boat rests when stowed on a vessel's deck.

Boat Davit.—A curved piece of timber or iron with a sheave at its outer end, which projects over the boat's stern, while the inner end is shipped into a cleat on each side of the bottom of the boat, for weighing anchors when needed.

Boatswain.—The officer who superintends the boat sails, ship-sails, rigging, canvas, colours, anchors, cables and cordage, committed to his charge. He ought also to take care that the blocks and running ropes are regularly placed to answer the purposes for which they are intended, and that the sails are properly fitted to their yards and stays, and well furled or reefed, when occasion requires. He pipes the hands to their several duties, and sees that they attend to his call; he ought to be in every way a thorough seaman. Although termed boatswain, the boats are not in his charge. They, with the spars, &c., and stores for repair, belong to the carpenter.

Boatswain's Mate is an assistant to the boatswain.

Boat the Oars.—Put them in their proper places fore and aft on the thwarts ready for use.

Bobstay Plates.—Iron plates by which the lower end of the bobstay is attached to the stem.

Body Plan.—The draught of a proposed ship, showing the breadth and timbers; it represents a section through the broadest part of the vessel; it is otherwise called the plan of projection.

Bollard.—A strong piece of iron or steel fixed to the deck round which to make a hawser or chain fast.

Bolsters.—Small cushions or bags of tarred canvas used to preserve the stays from being chafed by the motion of the masts, when the ship pitches at sea. Pieces of soft wood covered with canvas, placed on the trestle-trees, for the eyes of the rigging to rest upon, and to prevent a sharp nip.

Bolt.—A cylindrical pin of iron or copper to unite the different parts of a vessel, varied in form according to the places where they are required.

Bond of Bottomry.—An authority to borrow money by pledging the keel or bottom of the ship; that is, the ship itself.

Booby-Hatch.—A smaller kind of companion, but readily removable; it is in use for half-decks, and lifts off in one piece.

Boom.—A long spar run out from different places in the ship, to extend or boom out the foot of a particular sail; as, jib-boom, flying jib-boom, studding-sail booms, driver or spanker boom, main boom, square-sail boom, &c. A ship is said to come "booming forwards" when she comes with all the sail she can make. Boom also denotes a cable stretched

athwart the mouth of a river or harbour with yards, top-masts, or stout spars of wood lashed to it, to prevent the entrance of an enemy. To "top one's boom," is to start off. To "boom off," is to shove a boat or vessel away with spars.

Bore.—A sudden and rapid flow of tide in certain inlets of the sea.

Bottomree, or Bottomry Bond.—The contract of bottomry is a negotiable instrument, which may be put in suit by the person to whom it is transferred; it is in use in all countries of maritime commerce and interests. A contract in the nature of a mortgage of a ship, when the owner of it borrows money to enable him to carry on the voyage, and pledge the keel or bottom of the ship, as a security for the repayment. If the ship be lost, the lender loses all his money; but if it return in safety, then he receives back both the principal and the premium stipulated to be paid, however much it may exceed the usual or legal rate of interest. The affair is, however, only regarded as valid upon the ground of necessity; for, although more than the interest allowed by law may be exacted, it is not deemed to be usury.

Bout.—"Bout ship," the brief order for "about ship."

Bow.—The fore end of a ship or boat.

Bower-Anchors.—The anchors at the bows and in constant working use.

Bowse, To.—To pull upon any body with a tackle to haul it taut.

Box the Compass, To.—Signifies the ability to repeat the names of the thirty-two points in order both forwards and backwards, as also to answer any and all questions respecting the divisions of the compass-card.

Break-off.—Applied only when the wind will not allow of keeping the course.

Bring-to, To.—To check the course of a ship by trimming the sails so that they shall counteract each other and keep her nearly stationary; she is then said to lie by, or lie to, or heave to. "Bring to an anchor." The act of anchoring a vessel.

Broach-to, To.—To fly up into the wind. It generally happens when a ship is carrying a press of canvas with the wind on the quarter, and a good deal of after-sail set. The masts are endangered by the course being altered, since by bringing it more in opposition to the wind, the pressure of the wind on the sails is thereby increased. In extreme cases the sails are caught flat aback; in such case the masts are likely to give way, or the ship to go down stern foremost.

Broad Arrow.—The royal mark for government stores of every description.

Brow.—An inclined plane of planks, on one or both sides of a ship, to communicate internally; a stage gangway for the accommodation of the shipwrights, in conveying planks, timber, or weighty articles on board, Also, the face of a rising ground. An old term for a gang-board.

Buckle.—A mast buckles when it suffers by compression, so that the fibre takes a sinuous form, and the grain is upset; also, in Polar regions, the bending or arching of the ice upwards, preceding a ship.

Bull Rope.—A rope rove through a block in the bowsprit and bent to

a buoy the ship is moored to, to keep the buoy clear of the stern. A rope used to clear a foul anchor.

Bull's-eyes.—A flat circular piece of hard wood with a groove round the outside and a smooth hole through the centre for taking a rope through. Used in sails for receiving buntlines, &c., through them.

Bumkin.—Bumpkin, or Boomkin. A short boom or beam of metal or timber projecting from a ship. It is used to lead braces, &c., to.

Bung-Up and Bilge-Free.—A cask so placed that its bung-stave is uppermost, and it rests entirely on its beds.

Bunker.—The space allotted for stowing coal in steamers.

Buoy.—A sort of close cask, or block of wood, fastened by a rope to the anchor, to show its position. To "stream the buoy" is to let it fall from the ship's side into the water, which is always done before the anchor is let go, that it may not be fouled by the buoy-rope as it sinks to the bottom. Buoys of various kinds are also placed upon rocks or sand-banks to direct mariners where to avoid danger.

Butt.—The joining of two timbers or planks endways. In iron ships the end of the skin plates.

By.—On or close to the wind. "Full and by," not to lift or shiver the sails; rap-full.

By the Board.—Over the ship's side. When a mast is carried away near the deck it is said to "go by the board."

By the Head.—When a ship is deeper forward than aft.

By the Lee.—The situation of a vessel going free, when she has fallen off so much as to bring the wind round her stern, and to take her sails aback on the other side.

By the Stern.—When the ship draws more water aft than forward. (See *By the Head.*)

By the Wind is when a ship is sailed as nearly to the direction of the wind as possible.

Cable's Length.—A measure of about 101 fathoms, or $\frac{1}{10}$ of a nautical mile.

Call or Pipe.—A peculiar silver pipe or whistle, used by the boatswain and his mates to attract attention.

Can-Hooks.—They are used to sling a cask, by the chimes or ends of its staves, and are formed by reeving the two ends of a piece of rope or chain through the eyes of two flat hooks, and then making them fast. The tackle is then hooked to the middle of the bight.

Cant, To.—To turn anything about, so that it does not stand square.

Capstan, Cabestan, Capstern, Capston, &c.—A mechanical arrangement for lifting great weights, usually the anchors.

Capstan-Bars.—Long pieces of wood of the best ash or hickory, one end of which is thrust into the square holes in the drum head, like the spokes of a wheel. They are used to heave the capstan round, by the men setting their hands and chests against them, and walking round.

Careening.—The operation of heaving the ship down on one side.

Cast of the Lead.—The act of heaving the lead into the sea to ascertain what depth of water there is.

Cat's-paw.—A light air perceived at a distance in a calm by the impressions made on the surface of the sea, which it sweeps very gently, and then passes away, being equally partial and transitory.

Caulking.—Forcing a quantity of oakum, or old ropes untwisted and drawn asunder, into the seams of the planks.

Centre of Cavity, of Displacement, or of Immersion, are terms in naval architecture for the mean centre of that part of a vessel which is immersed in the water. The centre of buoyancy or that support given to a ship by the water on which she is immersed, coincides with the centre of cavity, &c.

Certificate.—A voucher or written testimony to the truth of any statement.

Chafe, To.—To rub or fret the surface of a rope, mast, or yard, by the motion of the ship or otherwise, against anything that is too hard for it. "Chafing-gear" is the stuff put upon the rigging and spars to prevent their being chafed.

Charter.—To charter a vessel is to take her to freight under a charter party.

Charter-Party.—The deed or written contract between the owners and the merchants for the hire of a ship, and safe delivery of the cargo.

Check.—To slack off a rope a little, and belay it again.

Cheeks of the Mast.—The faces of projecting parts on each side of the masts, formed to sustain the trestle-trees upon which the frame of the top, together with the top-mast, immediately rest.

Chine and Chine.—Casks stowed end to end.

Choke the Luff.—To place suddenly the fall of a tackle close to the block across the jaw of the next turn of the rope in the block, so as to prevent the leading part from rendering.

Clap On!—The order to lay hold of any rope, in order to haul upon it.

Clearance.—The document from the Customs, by which a vessel and her cargo, by entering all particulars at the Custom House and paying the dues, is permitted to clear out or sail.

Close-Hauled.—The general arrangement or trim of a ship's sails when she endeavours to progress in the nearest direction possible contrary to the wind.

Close-Reefed.—When under lower tops'ls and fores'l.

Coamings of the Hatches or Gratings.—Certain raised work about the edges of the hatch-openings of a ship, to prevent the water on deck from running down.

Coat.—A piece of tarred canvas nailed or secured round about the partners, or that part where the mast or bowsprit enters the deck. Its use is to prevent the water from running down between decks.

Cock-Bill.—The situation of the anchor when suspended from the cat-head ready for letting go.

Coil.—A certain quantity of rope laid up in ring fashion.

Companion.—A hatchway with a house or large fixed hatch over it to admit of entrance.

Company.—The whole crew of any ship, including her officers, men and boys.

Counter-sunk.—Those holes which are made for the heads of bolts, rivets or nails to be sunk in, so as to be even with the general surface.

Crane Lines.—Small lines for keeping the lee backstays from chafing against the yards.

Crank, or Crank-sided, is applied to a vessel which, by her construction or her stowage, is inclined to lean over a great deal; or which, from insufficient ballast or cargo, is incapable of carrying sail, without danger of overturning. The opposite term is "stiff," or the quality of standing well up to her canvas.

Crow-Foot.—A number of small lines spreading out from an arrow or long block, used to suspend the awnings by.

Davit.—A piece of timber or iron, with sheaves or blocks at its end, projecting over a vessel's side to hoist up and suspend one end of a boat or anchor.

Dead-Horse.—A term applied by seamen to labour which has been paid for in advance.

Dead Men.—The reef or gasket-ends carelessly left dangling under the yard when the sail is furled, instead of being tucked in. The cut roving in an unbent sail.

Dead-Water.—The eddy-water under the counter of a ship under way; it is so-called because it passes away slower than the water alongside.

Dead Weight.—A vessel's lading when it consists of heavy goods, but particularly such as pay freight according to their weight and not their stowage.

Derelict.—An abandoned vessel.

Ditty-Bag.—It is in use among seamen for holding their necessities.

Dock.—An artificial receptacle for shipping in which they can discharge or take in cargo and refit.

Dock Dues.—The charges made upon shipping for the use of docks.

Draught, or Draft.—The depth of water a ship displaces, or of a body of fluid necessary to float a vessel, hence a ship is said to draw so many feet of water when she requires that depth to float her; this is, for convenience, marked on the stem and stern-post from the keel upwards, in figures which are usually 6 inches long and 6 inches apart.

Drift.—The altered position of a vessel by current, or falling to leeward when hove-to or lying-to in a gale, when but little headway is made by the action of sails.

Drive, To.—A ship drives when her anchor trips or will not hold.

Drogue.—A spar or sea anchor used to lay a boat to at sea, or to prevent her being driven in on a beach too quickly, by hanging it over the stern to a line.

Dry Dock. (See *Graving Dock*.)

Dunnage.—Loose wood or other substances, as horns, rattan, coir, bamboo, &c., to stow amongst casks and other cargo to prevent their motion, and keep them free from bilge-water or sweat.

Embargo.—A temporary junction or arrest laid on ships or merchandise by public authority.

Entrance.—A term for the bow of a vessel.

Fair-Lead.—Those ropes which, suffering the least friction in a block, are said to "lead fair." Pieces of wood with holes in them to fix on to rigging, through which to lead ropes.

Fenders are lengths of spars cut up, or bundles of faggots tied together, and hung over the ship's side to prevent chafing against another vessel or against a wharf. The fenders of a boat are usually made of canvas, stuffed and neatly painted.

Fid.—A square bar of wood or iron, with a shoulder at one end, used to support the weight of a top-mast when erected at the head of the lower mast, by passing through a mortise or hole at the lower end of the former, and resting its ends on the trestle-trees, which are sustained by the head of the latter; the fid, therefore, must be withdrawn every time the mast is lowered; the top-gallant-mast is retained at the head of the top-mast in the same manner. A kind of wooden marline-spike.

Flat-aback.—When all the sails are blown with their after-surface against the mast, so as to give stern way.

Flatten In, To.—The action of hauling in the aftmost clew of a sail to give it greater power of turning the vessel.

Flemish, To.—To coil down a rope concentrically in the direction of the sun, or coil of a watch-spring, beginning in the middle without riders; but if there must be riding fakes they begin outside; the latter is the true French coil.

Flemish Horse is the outer, short foot-rope for the man at the earing of a square sail.

Floor.—The bottom of a vessel on each side of the keelson. When used in a strict sense, it is only so much of her bottom as she rests upon when aground. Such ships as have long and withal broad floors, lie on the ground with most security, whereas others which are narrow in the floor, fall over on their sides and are apt to break their timbers.

Fore-foot.—The foremost piece of the keel, or a timber which terminates the keel at the forward extremity, and forms a rest for the stem's lower end; it is connected by a scarph to the extremity of the keel; the other end of it, which is incurvated upwards into a sort of knee, is scarphed to the lower end of the stem; it is also called the gripe. As the lower arm of the fore-foot lies on the same level with the keel, so the upper one coincides with the middle line of the stem; its breadth and thickness therefore correspond with the dimensions of those pieces, and the heel of the cut-water is scarphed to its upper end.

Fothering is usually practised to stop a leak at sea. A heavy sail, as the sprit-sail, is closely thrummed with yarn and oakum, and drawn under the bottom; the pressure of the water drives the thrumming into the apertures.

Freight of a ship.—The hire, or part thereof, usually paid for the carriage and conveyance of goods by sea, or the sum agreed upon between the owner and the merchant for the hire and use of a vessel, at the rate of so much for the voyage, or by the month, or per ton.

Freshen the Nip, To.—To veer a small portion of a cable through the hawse-hole, or heave a little in, in order to let another part of it bear the stress and friction.

Full and By.—Sailing close-hauled on a wind.

Futtock-shrouds, or foot-hook shrouds, are short pieces of rope or chain which secure the lower dead-eyes and futtock-plates of topmast rigging to a band round a lower mast.

Gangway.—That part of a ship's side, and opening in her bulwarks, by which persons enter and depart, provided with a sufficient number of steps, or cleats, nailed upon the ship's side, nearly as low as the surface of the water, and sometimes furnished with a railed accommodation-ladder projecting from the ship's side, and secured by iron braces.

Garboard-strake, or **Sand-streak.**—The first range of plating laid upon a ship's bottom, next the keel, to which it is riveted.

Gasket.—A cord, or piece of plaited or other stuff, to secure furled sails to the yard.

Gear.—A general name for the rigging of any particular spar or sail.

General Average.—A claim made upon the owners of a ship and her cargo when the property of one or more has been sacrificed for the good of the whole.

Going Free.—Sailing with the wind abeam.

Grafting.—An ornamental weaving of fine yarns, &c., over the strop of a block; or applied to the tapered ends of the ropes, and termed pointing.

Grapnel, or **Grapling.**—A small anchor for boats, having a ring at one end, and four palmed claws at the other.

Gratings.—An open wood-work of cross battens and ledges forming cover for the hatchways, serving to give light and air to the lower decks.

Graving Dock, or **Dry Dock.**—An artificial receptacle used for the inspecting, repairing, and cleaning a vessel's bottom.

Gripes.—A broad plait formed by an assemblage of ropes, woven and fitted with thimbles and lanyards, used to steady the boats when hung in the davits, or upon the deck of a ship at sea. The gripes are fastened at their ends to ring-bolts in the deck, on each side of the boat, whence, passing over her middle and extremities, they are set up by means of the lanyards.

Ground, To.—To take the bottom, or shore; to be run aground through ignorance, violence, or accident.

Ground Swell.—A sudden swell preceding a gale, which rises along shore, often in fine weather, and when the sea beyond it is calm.

Guess-warp, or **Guest-rope.**—A rope carried to a distant object, in order to warp a vessel towards it, or to make fast a boat.

Guy.—A rope used to steady a weighty body from swinging against the ship's side while it is hoisting or lowering, particularly when there is a high

sea. Also a rope extended from the head of sheers, and made fast at a distance on each side to steady them.

Hailing.—To call to another vessel.

Hand.—A phrase often used for the word “man.”

Hanks.—Hoops or rings of rope, wood or iron, fixed upon the stays, to seize the luff of fore-and-aft sails, and to confine the stay-sails thereto at different distances.

Harbour Log.—That part of the log-book which consists solely of remarks, and which relates only to transactions while the ship is in port.

Harbour-Watch.—A division or sub-division of the watch kept on night duty, when the ship rides at right anchor to meet any emergency.

Hard-a-Lee.—The situation of the tiller when it brings the rudder hard over to windward.

Harness-Cask.—A large conical tub for containing the salt provisions intended for present consumption.

Hatchway.—A square or oblong opening in the middle of the deck of a ship.

Haul, To.—An expression peculiar to seamen, implying to pull or bowse at a single rope, without the assistance of blocks or other mechanical powers upon it.

Hawse Holes.—Cylindrical holes cut through the bows of a ship on each side of the stem, through which the cables pass.

Head to Wind.—The situation of a ship or boat when her head is pointed directly to windward.

Heart.—A block of wood or piece of metal forming a peculiar sort of triangular dead-eye, somewhat resembling the shape of a heart; it is furnished with only one large hole in the middle, grooved for the rope, instead of the three holes. It is principally attached to the stays, as the dead-eyes are to the shrouds.

Heel of a Mast.—The lower end which either fits into the step attached to the keel, or in top-masts is sustained by the fid upon the trestle-trees.

Hogged.—A significant word derived from the animal; it implies that the two ends of a ship's decks droop lower than the midship part, consequently, that her keel and bottom are so strained as to curve upwards. The term is therefore in opposition to that of “sagging.”

Hoist, or Hoise, To.—To raise anything.

Horns.—The points of the jaws of booms or gaffs. Also the outer ends of the cross trees.

Housing, or House-Line.—A small line formed of three fine strands, smaller than rope yarn; principally used for seizings of the block-strops, fastening the clews of sails to their bolt-ropes, and other purposes. (See *Marline*.)

Housing of a Lower Mast.—That part of a mast which is below deck to the step in the keelson; of a bowsprit, the portion within the knight-heads.

Hove Down.—The situation of a ship when heeled or placed thus for repairs.

Hove Short.—The ship with her cable hove taut towards her anchor.

Hove-To.—From the act of heaving-to; the motion of the ship stopped.

Hug, To.—To hug the land is to sail as near it as possible, the land, however, being to windward. To hug the wind, is to keep the ship as close-hauled to the wind as possible.

Hypothecation.—An authority to the master, amounting almost to a power of the absolute disposal of the ship; in a foreign country, he may hypothecate not only the hull, but his freight and cargo, for necessary and urgent repairs.

Injection Pipe.—This is fixed in the interior of a marine steam-engine, is fitted with a cock, and communicates with the water outside; it is for the purpose of playing into the condenser while the engine is working, and creating a vacuum.

Irons.—A ship is said to be in irons when, by mismanagement, she is permitted to come up in the wind and lose her way, rendering it difficult to throw the ship's head off on either tack, and so incurring the danger of making a stern board.

Jam, To, is to fix anything so that it cannot be freed without trouble and force.

Jaw.—The inner, hollowed, semi-circular end of a gaff or boom, which presses against the mast; the points of the jaw are called "horns."

Jib.—A large triangular sail, set on a stay at the forward end of a jib-boom.

Jib-boom.—A continuation of the bowsprit forward.

Jury-Mast.—A temporary or occasional mast erected in a ship in the place of one which has been carried away in a gale.

Kedge.—A small anchor used to warp a ship from one part of a harbour to another.

Keel.—The backbone or foundation of a ship upon which the rest of her structure is built. In wooden ships it consists of squared lengths of suitable timber which are joined at the ends by strong scarphs. In iron ships there are various kinds, bar, side bar, and flat plate keels.

Keelsons are secondary keels fitted internally for the purpose of adding to the longitudinal strength of the ship's bottom.*

Keep your Luff.—An order to the helmsman to keep the ship close to the wind.

Kink.—An accidental curling twist, or doubling turn in a cable or rope.

Knees are pieces of bent iron or steel for connecting certain parts of vessels together, such as the beams or girders to the ribs or frames. In some cases the beams themselves are bent at the ends into knee shapes.

* For full description refer to Walton's "Know Your Own Ship," published by Messrs. Charles Griffin & Co., Ltd., in their *Nautical Series*. 5s.

Knight-Heads.—The upper parts of the bows immediately each side of the bowsprit.

Lacing.—Small line used for hauling out an awning to the ridge ropes, and also for connecting parts of an awning together.

Lanyard.—A short piece of rope or line made fast to anything to secure it, or to serve as a handle.

Lay, To.—To come or go, as lay aloft, lay forward, lay aft, lay out.

Lee.—It is the side opposite to that from which the wind is blowing.

Leeway is the distance a vessel loses by drifting to leeward of her course.

Let Fall.—The order to drop a sail loosed from its gaskets in order to set it.

Lie-to, To.—To cause a vessel to keep her head steady, and as close to the wind as possible in a gale, so that a heavy sea may not tumble into her. She has perhaps a lower main-topsail or trysails, and comes up to within six points, and falls off to wind abeam, forging rather ahead, but should not be permitted to fall too much to leeward.

Lifts.—Ropes which reach from each mast-head to their respective yard-arms to steady and suspend the ends.

List, To.—To incline to one side.

Lizard.—A piece of rope, sometimes with two legs, and one or more iron thimbles spliced into it.

Load Water Line.—The draught of water exhibited when the ship is properly loaded.

Log-Book.—Generally called the log, is a journal into which the log-board is daily transcribed, together with any other circumstance deserving notice. The intermediate divisions or watches are usually signed by the commanding officer. It is also divided into harbour-log and sea-log.

Look-Out.—The man stationed on the forecastle head or forebridge at night time, or in crowded waters or fog, whenever that may be. He reports everything he sees to the officer on duty.

Lubber's-Hole.—The vacant space between the head of a lower-mast and the edge of the top.

Luff.—The order to the helmsman to bring the ship's head up more to windward.

Make Fast.—A word generally used for tying or securing ropes. To fasten.

Man, To.—To provide a competent number of hands for working a ship or boat.

Manifest.—An official inventory of the cargo of a merchant ship, specifying the name and tonnage of the vessel, the description of goods, the names of shippers and consignees, and the marks of each package.

Mast.—A long cylindrical piece of timber, or iron or steel cylinder elevated perpendicularly upon the keel of a ship, to which are attached the yards, the rigging, and the sails.

Mast-Coat.—A conical canvas fitted over the wedges round the mast, to prevent water oozing down from the decks.

Meet Her.—The order to adjust the helm, so as to check any further movement of the ship's head in a given direction.

Metacentre.—In a ship lying perfectly in equilibrium, or upright, a line drawn perpendicular to the keel passes through both the centre of cavity, or buoyancy, and the centre of gravity of the ship. When the ship is heeled to any angle, the centre of buoyancy, owing to the change in the form of the ship immersed, is shifted out of that perpendicular line towards the side to which the ship is heeled in proportion to the angle of heel. A vertical line drawn from this new centre of buoyancy cuts the perpendicular line drawn through the centre of gravity, and the point at which it cuts it is called the **METACENTRE**. The distance between that point, or the metacentre, and the centre of gravity is called the **metacentric height**, and upon the measure of that height depends the leverage, or power of the ship, to right herself when the force which heels her (such as wind) is withdrawn, or to prevent her heeling further if the force is continued. If the centre of buoyancy shifts so much that the vertical line drawn from it cuts the before-mentioned perpendicular line at or below the centre of gravity the righting power is lost, and the ship will capsize; therefore to be safe the metacentric point must always be above the centre of gravity.*

Midships.—The middle part of the vessel, either with regard to her length or breadth.

Missing Stays.—To fail in going about from one tack to another.

Moorings are indicated by buoys to which ships are fastened; they are attached by bridles to heavy anchors and cables laid down in the most convenient parts of rivers and harbours.

Mould-loft.—A long building, on the floor of which the intended vessel is laid off from the several draughts in full dimensions.

Mousing.—A lashing connecting the bill of a hook with the shank.

Nettles.—Small line used for seizings, and for hammock-clews.

Nip.—A short turn in a rope.

Off and On.—When a ship beating to windward approaches the shore by one board, and recedes from it when on the other.

On End.—Top-masts and topgallant-masts are on end, when they are in their places, and sail can be set on them.

Open Hawse.—When a vessel rides by two anchors without any cross in her cables.

Painter.—A rope attached to the bows of a boat, used for making her fast; it is spliced with a thimble to a ring-bolt inside the stem.

Partners.—A frame-work of beams, fitted round the several scuttles or holes in a ship's decks, through which the masts, capstan, etc., pass.

Pauls or Pawls.—A stout, but short, set of bars of iron fixed close to the capstan-whelps, or windlass of a ship, to prevent them from recoiling and overpowering the men.

Pig-Iron.—An oblong mass of cast-iron or lead used for ballast.

Pipe. (See *Call.*)

* See Walton's "Know your own Ship" for further explanation of this somewhat difficult but interesting problem.

Port-Charges, or Harbour Dues.—Charges levied on vessels resorting to a port.

Pratique.—The licence to trade and communicate with any place after having performed the required quarantine, or upon the production of a clean bill of health.

Protest.—A formal declaration drawn up in writing, and attested before a notary public, a justice of the peace, or a consul in foreign parts, by the master of a merchant ship, his mate, and a part of the ship's crew, after the expiration of a voyage in which the ship has suffered in her hull, rigging, or cargo, to show that such damage did not happen through neglect or misconduct on their part.

Purchase.—Any mechanical power which increases the force applied.

Quarantine.—A seclusion from a free communication with the inhabitants of any country.

Rendering.—Any rope, hawser, or cable is “rendered” by easing it round the bitts.

Respondentia.—A loan made upon goods laden in a ship, for which the borrower is personally responsible; differing therein from bottomry, where the ship and tackle are liable. In bottomry the lender runs no risk, though the goods should be lost; and upon “respondentia” the lender must be paid his principal and interest, though the ship perish, provided the goods are safe.

Ride, To.—To ride at anchor.

Ridge-Rope.—The centre rope of an awning.

Roach.—The hollow curvature of the lower parts of upper square-sails to clear the stays when the yards are braced up.

Run.—The aftermost part of a ship's bottom.

Run out a Warp.—To carry a hawser out from the ship by a boat, and fasten it to some distant place to remove the ship towards that place, or to keep her steady whilst her anchors are lifted, &c.

Sagging is a term applied when the centre part of a ship droops.

Scantlings.—The sizes of different parts of a ship, which are determined from certain figures obtained from combinations of the length, breadth and depth of vessels.

Scuttle.—A small hole or port cut either in the deck or side of a ship, generally for ventilation.

Serving-Board.—A flattened piece of hard wood with a handle, for passing service on the smaller ropes.

Serving Mallet.—The mallet, grooved on the under side, with which spun yarn, or other small stuff, is wrapped tightly round a rope.

Sheer.—The longitudinal curve of a ship's decks or sides upwards towards the ends; a good sheer adds to a vessel's buoyancy, and a certain amount is now insisted upon by the new free-board rules. A perfectly straight ship is said to have “no sheer.” Should the ends droop, a ship is said to be out of “sheer.”

Ship's Papers.—Documents descriptive of a vessel, her owners, cargo, destination and other particulars necessary for the court of instance.

Shore.—A prop put under a ship's deck to distribute the strain caused by the foot of a derrick or sheers.

Sill of a Dock.—The timber at the base against which the gates shut; the depth of water which will float a vessel in or out of it is measured from it to the surface.

Slack in Stays.—Slow in going about.

Slip.—The difference between the speed of a vessel and the speed of the propeller.

Sounding.—The operation of ascertaining the depth of the sea and the quality of the ground by means of a lead and line.

Span.—A rope with both ends made fast, so that a purchase may be hooked to its bight.

Spell.—The period wherein one or more sailors are employed in particular duties demanding continuous exertion.

Spring.—A hawser laid out to some fixed object to slue a vessel proceeding to sea.

Spurlingate.—The opening in the deck through which the chain cable goes.

Start.—To start, applied to liquids, is to empty. To "start a tack or sheet"; to slack it off, as in tacking or manœuvring. "Raise tacks and sheets."

Staysail.—A triangular sail hoisted upon a stay.

Stem.—The foremost piece uniting the bows of a ship.

Step.—The block in which the heel of a lower mast rests.

Stern Board.—This term is familiarly known to seamen as tacking by misadventure in stays, or purposely, as a seamanlike measure, to effect the object. Thus a ship in a narrow channel is allowed to fly up head to wind until her stem nearly touches a weather danger; the head yards are then quickly braced abox and the helm shifted. Thus she makes stern-way until all the sails are full, when she is again skilfully brought to the wind before touching the danger under her lee. Generally speaking, however, it refers to bad seamanship.

Stowage.—An important art more practised than understood, for the stower seldom consults the specialities of the vessel's construction. It is the general disposition of the ballast, cargo, etc., contained in a ship's hold with regard to their shape, size, or solidity, agreeably to the form of the vessel and its probable centre of gravity. A badly stowed vessel cannot be properly handled, and is indeed dangerous to the lives of all on board. Owners and masters are legally liable to the losses from bad stowage or deficient dunnage.

Stranded.—A rope is stranded when one of its strands is broken by chafing, or by a strain. A vessel is stranded when driven on shore.

Stream the Buoy.—To let the buoy fall into the water before letting go the anchor.

Swab.—A sort of long mop, formed of rope-yarns of old junk, used for cleaning and drying the decks.

Swig Off, To.—To pull at the bight of a rope by jerks, having its lower end fast.

Sword-Mat.—A mat made with shoulders to protect the lanyards of the lower rigging, boat's gripes, &c., and worked by a piece of wood somewhat resembling a sword in shape, to drive home the roving threads.

Tail-Block.—A rope-stopped block, having an end of rope attached to it as a tail, by which it may be fastened to any object at pleasure.

Tarpaulin.—Canvas well covered with tar or paint to render it waterproof.

Tender.—A synonym of crank, as applied to a ship.

Thole-Pin.—Pins in the gunwale of a boat, and serving to retain the oars in position when pulling.

Throttle-Valve.—A valve in the steam-pipe of an engine for preventing the escape of steam, or regulating the velocity of its passage from the boiler to the cylinder.

Tonnage.—The cubical contents of a vessel allowing 100 cubic feet to the ton. The continental equivalent is 2·8316 cubic metres.

Gross Tonnage is the total cubic capacity of every enclosed space on board ship.

Net Tonnage is that space available for cargo only.

Register Tonnage is that measured and entered on the ship's register; it is practically the same as net tonnage.

Torts.—Private wrongs either to persons or property afloat. They are cognisable by the Admiralty Court, according to locality.

Tow.—To draw or drag a vessel along by means of a rope or hawser.

Trucks.—Circular caps on the upper mast-heads; they are generally furnished with two or more small sheaves, through which the signal halliards are rove.

Under Foot.—Under the ship's bottom; said of an anchor which is dropped while she has headway.

Under Way.—When a vessel is moving through the water.

Under Weigh, To get.—Preparing to get under way by loosing the sails and getting up steam and weighing the anchor.

Unrig, To.—To dismantle a ship of her standing and running rigging.

Up with the Helm.—Put it a-weather.

Uvrou.—The circular piece of wood, with holes in it, by which the legs of a crow-foot are extended for suspending an awning.

Vane.—A piece of bunting extended on a wooden stock, which turns upon a spindle at the mast-head. It shows the direction of the wind.

Veer, To.—To let out, to pay out.

Veer and Haul.—To gently tauten and then slacken a rope three times before giving a heavy pull, the object being to concentrate the force of several men. The wind is said to veer and haul when it alters its direction; thus it is said to veer aft and haul forward.

Veer away the Cable, To.—To slack and let it run out.

Ventilator.—The names of various machines contrived to expel the foul air from below decks, and introduce fresh in its stead.

Wake.—The transient, generally smooth, track impressed on the surface-water by a ship's progress.

Water-Logged.—The state of a ship full of water, having such a buoyant cargo that she does not sink.

Water-Ways.—The strake on the inside of a vessel in line with the edge of the upper deck, forming a gutter way to lead the water off the deck to the scuppers.

Weather-Helm.—A ship is said to carry a weather-helm when she is inclined to gripe, or come too near the wind, and therefore requires the helm to be kept constantly a little to windward.

Well is the part of the vessel where any water that leaks into the ship can collect, and from thence it is pumped overboard.

Windlass.—A machine erected in the fore-part of a ship which serves to ride by, as well as heave in the cable.

Yard.—A long cylindrical timber or iron or steel cylinder suspended upon the mast of a vessel to spread a sail.

Yard Arm.—That part of a yard outside the quarter.

APPENDIX I.

DIPPING THE ENSIGN.

Dipping the Ensign, as the operation is called, whereby one ship salutes another, is carried out by the ensign being slowly hauled down the staff, or from the peak, about half way, and then after a slight pause hoisting it again slowly, taking care at the same time that the halliards are kept taut.

It is difficult to lay down any hard and fast rules for the guidance of officers, but it may be generally considered that :

1. A junior dips first to a senior.
2. A merchant ship dips to a man-of-war. In the case of a squadron to the flagship.
3. The flags should be dipped when the ships are abreast, the vessel taking the initiative making a slightly longer pause in order to give the other vessel a chance of answering.

It is customary now to make only one dip.

APPENDIX II.

LIGHTHOUSES AND LIGHT-VESSELS.

SAILORS should study the different systems of lights used in **Lighthouses** and **Light-vessels**.

Lighthouses are distinguished (for daylight purposes) by colour, stripes, squares, bands, &c. ; at night by the quality and style of their light. They are built of stone or iron, and are sometimes placed on piles. In fogs they are distinguished by sound—gongs, whistles, syrens, explosives, &c.

The lights used in lighthouses and light-vessels are of several kinds :—

1. **Fixed**, a steady burning light.
2. **Revolving**, where by means of mechanism the light is hidden at times, the change from darkness to light, and back again, being comparatively gradual.
3. **Flashing**, showing flashes of light at certain intervals.
4. **Occulting**, in which the light is suddenly extinguished and as suddenly exposed.

At times there are combinations of these systems, and variation is obtained by different time intervals.

The light is obtained by burning oil (paraffin or a vegetable oil), gas, or the electric light. In the two former cases by means of an elaborate system of wicks or burners, and in the latter by means of the carbon points.

Great attention is given to the construction of the glass cases which contain the lights and in the system of reflection. The two systems in use are the **catoptric** or reflector system, and the **dioptric** or lens system.

These two systems are now constantly combined in the best lights and are known as the **holophotal** system, the loss of light in which is exceedingly small.

Buoys mark shoals or edges of shoals and such like, and are of various kinds and shapes :

1. **Bell-buoys** have a bell on them which rings by the motion of the waves.

2. **Gas-buoys** are illuminated with a gas jet, the gas being stored in the buoy.
3. **Sound-buoys** make a noise.
4. Telegraph cables and wrecks are marked by **green buoys**, in the former case having **Telegraph** in white letters printed on them, in the latter by green buoys with **Wreck** painted in white on them.

The different sides of a channel are marked also with different styles of buoys. The system used by the Trinity House has them painted one colour on the starboard side of a channel (that is the right hand side entering a harbour), and parti-coloured buoys on the port side.

There are also pillar-buoys and spar-buoys.

Beacons are marks placed on shoals and points of land as marking points, and are of various kinds, sometimes a pile of stones, or a wooden or iron pillar, and the like.

APPENDIX III.

SOUNDING TABLE.

THE following table is very useful for correcting flying soundings, and is used in the following manner:—Suppose the vessel is going 6 knots and a sounding is taken; the dial registers 90 fathoms. Refer to the table with 90 fathoms in the left hand column, and under 6 knots will be found a correction - $26\frac{1}{2}$ to be applied; this gives a true depth of $63\frac{1}{2}$ fathoms, a result quite close enough for practical purposes.

Correction to be applied to the apparent sounding to obtain the true depth.*

Knot = 6086·7 feet. Lead (30 lbs.) descends 100 fathoms in 60s.

Depth in fathoms as registered on Machine.	SPEED OF SHIP.		
	4 knots or 6·7 ft. per second.	6 knots or 10·1 ft. per second.	8 knots or 13·5 ft. per second.
	fathoms	fathoms	fathoms
170	—	—	- 69
160	—	—	- 65
150	—	- 44	- 61
140	—	- 41	- 57
130	- $22\frac{1}{4}$	- 38	- 53
120	- 21	- 35	- $48\frac{3}{4}$
110	- $18\frac{3}{4}$	- $32\frac{1}{4}$	- $44\frac{3}{4}$
100	- 17	- $29\frac{1}{4}$	- $40\frac{1}{2}$
90	- $15\frac{1}{2}$	- $26\frac{1}{2}$	- $36\frac{1}{2}$
80	- $13\frac{3}{4}$	- $23\frac{1}{2}$	- $32\frac{1}{4}$
70	- 12	- $20\frac{1}{2}$	- $28\frac{1}{2}$
60	- $10\frac{1}{2}$	- $17\frac{1}{2}$	- $24\frac{1}{4}$
50	- $8\frac{1}{2}$	- $14\frac{1}{2}$	- $20\frac{1}{4}$
40	- $6\frac{3}{4}$	- $11\frac{3}{4}$	- $16\frac{1}{4}$
30	- 5	- $8\frac{3}{4}$	- $12\frac{1}{4}$
20	- $3\frac{1}{2}$	- 6	- 8
10	- $1\frac{3}{4}$	- 3	- 4
5	- 1	- $1\frac{1}{2}$	- 2

* "Sounding in Shallow Water." Paper read before the Shipmasters' Society, London, on February 27, 1891.

RULES OF THE ROAD.*

THE Rule of the Road has been formulated to enable vessels to navigate the sea expeditiously and safely, without coming into collision; it has been elaborated from a few rules accepted by custom and dating from the early days of sailing ships.

Lights should be placed out at sunset, and taken in at sunrise.

The word **visible** in the Rules, when applied to lights required to be carried, means visible on a dark night with a clear atmosphere.

Any vessel propelled by machinery is included under the term **steam-vessel**. But she is considered a **sailing-vessel** if she is proceeding under sail only, and the machinery not working.

A vessel is considered **under way** when she is not at anchor or made fast to the ground or aground.

(1) **A vessel under 150 feet** in length shall exhibit when **at anchor** (whether steam or sailing), at night time in the forward end of her, a white light at a height not exceeding 20 feet above the hull, and constructed so as to show a uniform unbroken light all round the horizon to a distance of at least one mile.

If the vessel is **over 150 feet** long she shall carry the same kind of light not less than 20 feet above the hull, and not exceeding 40 feet above the hull, and shall carry in addition, at or near the stern, another white light of a similar character at a height not less than 15 feet below the forward light.

A vessel aground in or near a fair way shall carry the above light or lights, and the two red lights prescribed by par. 9 (b).

To fulfil these conditions the forward light is generally hung in the fore-rigging.

(2) **Sailing vessels when under way**, and any vessel being towed, shall exhibit a green light on the starboard side of the vessel, and a red light on the port side.

(3) **A steamer when under way**, shall carry, in addition to the coloured lights of a sailing vessel, a white mast-head light in front of the foremast, or in the fore part of the vessel; at a height not less than 20 feet above the hull. Should the beam of the vessel exceed 20 feet, the white light must be carried at a height not less than the beam, up to but not greater than 40 feet.

(4†) Each coloured or side-light should show an unbroken light over an area of ten points, that is, from right ahead of the vessel to two points abaft the beam, and the mast-head light should show an unbroken light from right ahead to two points abaft the beam on both sides; thus show-

* Coming into force July 1, 1897. To be used instead of regulations given on p. 85 to end of par. (15) p. 87.

† For the exact arc over which the light shows, and means adopted to attain this end, see Board of Trade Regulations.

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ing over twenty points of the compass and covering the same arc as the combined side lights.

The mast-head light should be visible at a distance of at least 5 miles, and the coloured side-lights at a distance of at least 2 miles. A steamer may, in addition to the three lights mentioned in (3), carry an additional similar white light in a fore and aft line with the other. These two lights shall be so placed that the after and higher light shall be 15 feet above the forward light, and that the horizontal distance between the lights shall be greater than the vertical distance.

(5) **A vessel being overtaken by another** shall show over the stern at (as nearly as is practicable) the same height as the side-lights, a white light in a lantern so constructed that the light shows on each side of the stern over an arc of six points and is visible at a distance of at least one mile.

(6) **A steamer towing another vessel** shall carry, in addition to her ordinary lights, a similar white light under the mast-head light, at a distance of not less than 6 feet vertically below it.

If **more** than one vessel is being towed, and the length of the tow, from the stern of the towing vessel to the stern of the last vessel towed exceed 600 feet, she shall carry an additional similar mast-head light 6 feet above or below the other lights, and not less than 14 feet above the hull.

A vessel towing may also carry a small white light in the after part of her for the vessel towed to steer by, but such light should not be visible before the beam.

(7) **[a] Steam vessels of less than 40 and vessels under oars** or sails of less than 20 tons gross tonnage respectively, and rowing-boats when under way, are not obliged to carry the lights mentioned in pars. (2) and (3), but shall, in the case of (a) a steam vessel, carry in the fore part of the vessel in front of the funnel, and where it can best be seen, at a height of not less than 9 feet above the gunwale, a white light constructed as in par. (3), and of such a character as to be visible at least 2 miles, and shall carry side-lights at least 3 feet below the white light, and of such a character as to be visible at least one mile off. The side-lights can be either separate or combined.

Small launches, such as are carried by sea-going vessels, may carry the white light at a less height than 9 feet, but it must be carried above the side-lights.

(8) **[a] Sailing pilot vessels** when engaged on pilotage duty shall carry a white mast-head light visible all round the horizon, and shall exhibit a flare-up at least every 15 minutes.

(b) **Steam pilot vessels** shall carry, in addition to the white mast-head light, a red light, 8 feet below it, visible all round the horizon at a distance of not less than two miles. They shall also carry the coloured side-lights. When at anchor they shall only exhibit the white and red mast-head lights.

(c) **Sailing pilot vessels** shall, on the near approach of or to another vessel, have their side-lights ready to show over their respective sides to indicate the way they are heading.

(d) **A pilot vessel** of such a class as to be obliged to go alongside a vessel to put a pilot on board, may show the white light instead of carrying it at the mast-head, and may have a lantern ready for use with a green glass on one side and a red glass on the other to act as in (c).

(e) **Pilot vessels under way** and not on duty shall carry lights similar to those of their own tonnage.

(9) **[a] Telegraph ships when under way**, or at work on cables,

RULES OF THE ROAD.

shall carry in place of the white mast-head light three lights in a vertical line one over the other not less than 6 feet apart. The highest and lowest of these lights shall be red and the middle one white, and they shall be of such a character as to be visible all round the horizon at a distance of at least 2 miles.

In the daytime three shapes shall be carried in the same place, the upper and lower of which shall be globular in form and red in colour, and the middle one shall be white in colour and diamond in form. These shapes shall not be less than 2 feet in diameter.

When telegraph ships are at work and making way through the water they shall carry the coloured side lights in addition to the above.

(b) **A vessel not under command** shall carry at night time at the same height as the white light (3), and, if a steamer, in place of it, two red lights in a vertical line, one over the other, not less than 6 feet apart, and of such a character as to be visible all round the horizon at a distance of at least 2 miles. In the daytime, two black balls or shapes, each 2 feet in diameter, shall be carried in place of, and in the same relative positions as, the lights.

(c) Vessels referred to here, when making any way through the water shall, in addition to the special lights, carry the coloured side-lights.

(d) **Other vessels** must understand that these special lights and shapes are not distress signals, but merely indicate that the vessels showing them cannot get out of the way.

(e) **A steam vessel under sail only**, but with her funnel up, shall carry in the daytime, forward where it can best be seen, one black ball or shape 2 feet in diameter.

(10) [a] **In fog, mist, falling snow, or heavy rain storms**, whether by day or night, steam vessels shall indicate their presence by whistle or "siren;" sailing vessels or vessels towed, by foghorn; and vessels at anchor by a bell. A prolonged blast lasts 4 to 6 seconds.

In all cases where a bell is required to be used, a drum may be used in a Turkish vessel, or a gong in any small sea-going vessel. The place from which these signals are sounded should be as free from obstruction as possible. In all such cases a vessel should proceed at a moderate speed (4 knots) and should navigate with the greatest caution.

(b) **A steam vessel under way** shall give a prolonged blast or whistle at least every 2 minutes. If stopped and having no way on her, she shall sound at intervals of not more than 2 minutes two prolonged blasts with an interval of about 1 second between them.

(c) **A sailing vessel** when under way shall sound at intervals of not more than 1 minute, when on the starboard tack one blast, when on the port tack two blasts in succession, and with the wind abaft the beam three blasts in succession.

(d) **A vessel when at anchor** shall ring the bell rapidly for about 5 seconds at intervals of not more than one minute.

(e) A vessel, when towing a vessel employed in laying or picking up a telegraph cable, and a vessel under way but not under proper command, shall sound at intervals of not more than 2 minutes, three blasts in quick succession; viz., one prolonged blast followed by two short blasts (— . .). A vessel towed may give this signal and no other.

(f) **Sailing vessels and boats under 20 tons** burden shall not be obliged to give the ordinary signals; but if they do not they must make some other efficient sound-signal at intervals of not more than 1 minute.

(11) [a] **Small sailing vessels** under way in bad weather, which find it difficult to carry the side lights in their proper places, may carry

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these lamps lighted and ready at once to show over their respective sides on the near approach of, or when nearing another vessel, and in sufficient time to prevent collision. Still smaller vessels, as open boats and such like, may carry a lamp having a green glass on one side and a red glass on the other. Care is to be taken in all cases to exhibit the lights on the proper sides.

(b) **Rowing boats**, under oars or sails, shall carry a lantern giving a white light, which shall be temporarily exhibited in time to prevent a collision.

REMARKS.

By custom, the following signals have been adopted for vessels in sight of one another, but they are not compulsory, and must not be used as fog-signals.

In steamers, one short blast (·) means "I am directing my course to starboard;" two short blasts (· ·) "I am directing my course to port," and three short blasts (· · ·) "I am going full speed astern."

In going through narrow channels keep to the right or starboard hand, as in walking.

One vessel overtaking another keeps out of its way, and an overtaking vessel is defined as one coming up with another vessel but more than 2 points abaft the latter's beam, being thus unable to see the lights.

Every vessel may, if necessary, in order to attract attention, in addition to her proper lights, show a "flare-up" or use a detonating signal that cannot be mistaken for a distress signal.

None of these Rules interfere with special extra signals used by different governments in their warships and by shipowners as private signals which are authorised.

Vessels should avoid approaching too near squadrons of war ships, or attempting to pass ahead of or break through their lines or formations.

Nothing in these Rules shall exonerate any vessel, or the owner or master or crew thereof, from the consequences of any neglect to carry lights or signals, or to keep a proper look-out, or of any precautions required by the ordinary practice of seamen; at the same time, due regard shall be paid to all dangers of navigation and collision and to any special circumstances which may render a departure from the above Rules necessary in order to avoid immediate danger.

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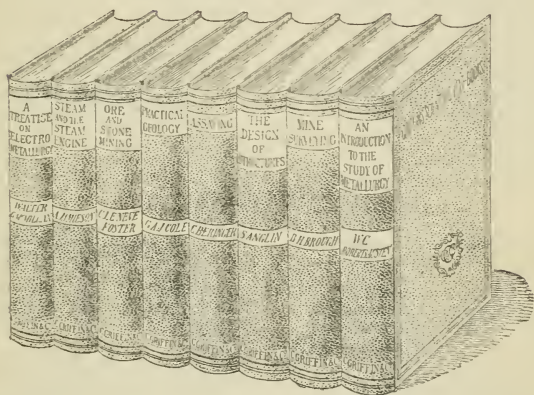
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
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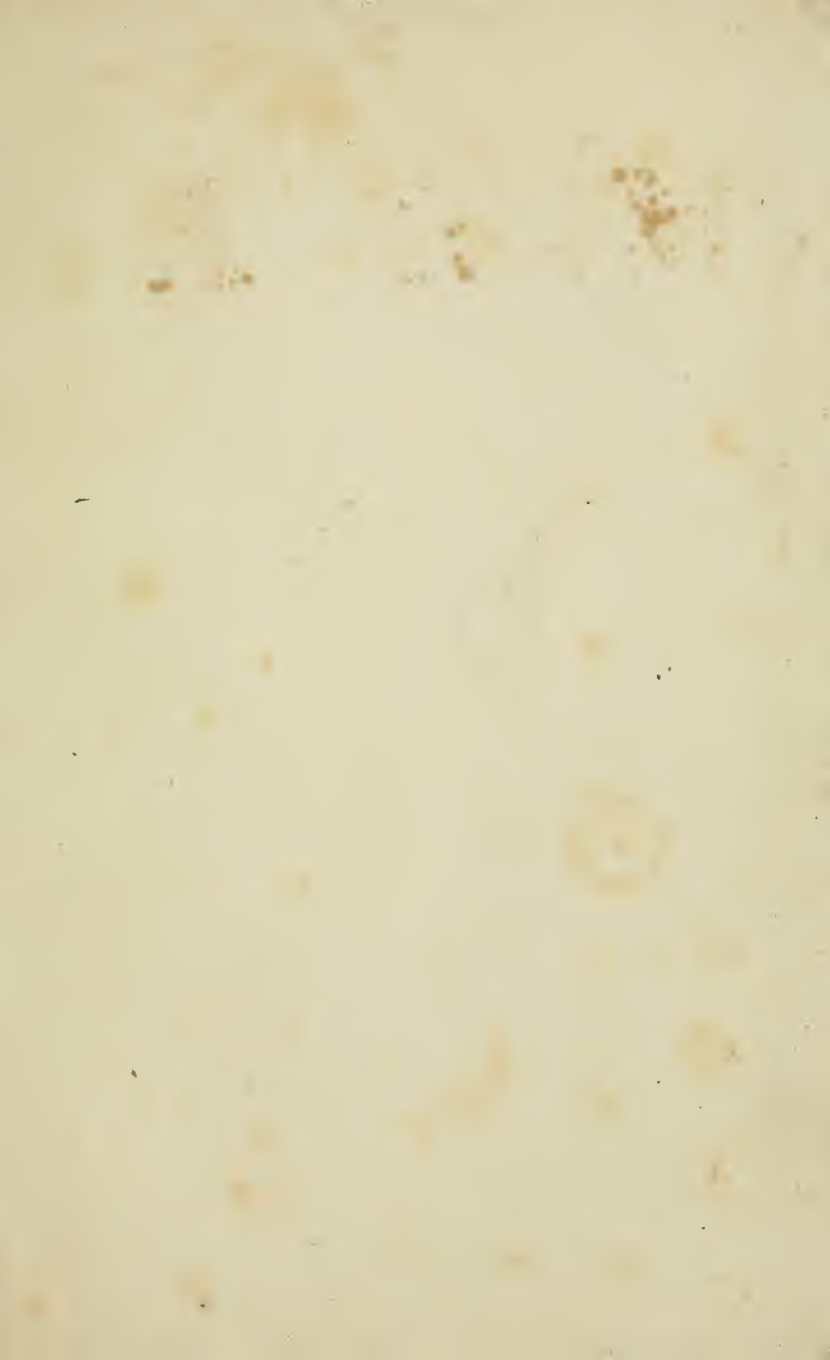
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